Gelechiid moths of the genus *Mirificarma*

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Synopsis

The Palaearctic genus *Mirificarma* is revised and three new species are described. Twenty-one species are recognized and four synonyms are newly established; seven new generic combinations are included. Keys to the species, and figures of the external features and genitalia of all the species are given. The systematic position of *Mirificarma* is discussed and a provisional classification of the species based on a cladistic analysis is provided, together with an account of the filament, a unique structure of the male genitalia of *Mirificarma*. Biological data, as far as known, are given for all the species, and the host-plant relationships within the genus are discussed.

Introduction

The genus *Mirificarma* consists of 21 species of Microlepidoptera from Europe and the Mediterranean region, with one species introduced to the U.S.A. The moths are of average size for Gelechiidae, with a wingspan usually between one and two centimetres. They vary in wing pattern; some species have the fore wing with yellowish zig-zag markings, others have spots, a median longitudinal stripe, or are almost uniform in colour. The larvae feed on Leguminosae.

Mirificarma cannot be defined readily on external characters and, since early microlepidopterists relied on such characters, many species have been misplaced in other genera. Hitherto, no comprehensive account of the genus has been given, although a partial revision by Sattler (1960: 41–45) covered aspects of eight species.

The purpose of this study is to describe three new species, to include seven previously misplaced species and to provide a key by which all the species can be identified. In addition, this study examines the host-plant relationships within *Mirificarma*, describes the structure of the filament, a character of the male genitalia unique to the genus, investigates the systematic position of the genus within the Gelechiidae and proposes a classification of the species within *Mirificarma*.

This study aims to resolve the confusion over the interpretation of the filament and its

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associated structures. Moreover, examination of these structures has helped to indicate the relationships of *Mirificarma* within the Gelechiidae.

Photographs of the wings of every species are reproduced but should only be used as a rough guide for identification. The wing patterns of some species are very similar and, in a few cases, considerable variation within species can make identification very difficult. However, there are abundant distinct genitalic differences between *Mirificarma* species and, to enable accurate determination, the key is based mainly on these.

The leguminous host-plants are of particular interest since they provide evidence to corroborate the division of the genus into species-groups. Two species, *flavella* and *eburnella*, feed on plants grown as fodder-crops but neither is recorded as an agricultural pest in Europe. However, *eburnella* has been introduced to the U.S.A. where it has caused severe damage to clover and vetch crops (see p. 28).

Methods

The measurements given at the beginning of each description are the range in fore wing length of the specimens examined, to the nearest half millimetre. Measurements which are far outside the normal range for a species are given in parentheses, in addition to the range for the other specimens examined of the species. The length of the apophysis anterior in the female genitalia was measured from the apex of the apophysis to the level at which it joins the antrum. Since the apophyses anteriores are sometimes of unequal length, the range in length given is derived from the mean of the pair. The number of specimens examined is given in parentheses after this measurement.

Standard methods of genitalia preparation were followed except that where sufficient material was available, the vinculum was separated from the tegumen on one side of the male genitalia and laid out flat beside the tegumen, in order that the complex structures should be more clearly displayed in the photographs. This has also facilitated the examination of the structures. For staining, mercurochrome was used. The terminology of the genitalia follows that of Klots (1956) and Sattler (1979). The descriptions of the sacculus refer to the posterior portion of this which is free from the vinculum.

The specimens examined are deposited in the British Museum (Natural History) unless otherwise stated. Records from Mr E. Jäckh, Bidingen are based on photographs of genitalia preparations only. The data of type-material are given in full and sometimes include information from the original description, additional to that from the specimen label; data from sources other than these are given in square brackets. Data of specimens other than types are abbreviated by omitting collectors' names and dates other than months. For widespread and well-documented species localities are summarized under country, with province or region where appropriate. The spelling of locality names follows *The Times Atlas of the World* (Comprehensive Edn), 1968, as far as possible. The distribution records are based on material examined unless otherwise stated.

Most of the specimens examined in this study bear my determination labels dated '1982' or earlier. Any specimens with subsequent determination labels are not included.

Lectotype designations are made where necessary, in some cases for species which were based on an unspecified number of specimens, even where only one original specimen is currently known. Lectotypes are also designated for species described by Walsingham where he referred to a 'type ♂' and a 'type ♀' but did not specify a single 'type' or holotype. In these cases the specimen selected is that listed first by Walsingham, usually the male. These lectotype designations follow the practice discussed by Sattler (1976: 89).

Some of the photographs of the wings have been reversed.

The botanical nomenclature and classification follow Polhill & Raven (1981); European plant names not included in that work follow Tutin *et alii* (1964–1980).

Abbreviations of institutions

BMNH	British Museum (Natural History), London.
LN	Landessamlungen für Naturkunde, Karlsruhe.
MINGA	Muzeul de Istorie Naturală 'Grigore Antipa', Bucharest.
MNHN	Muséum National d'Histoire Naturelle, Paris.
MNHU	Museum für Naturkunde der Humboldt-Universität, Berlin.
NM	Naturhistorisches Museum, Vienna.
TM	Természettudományi Múzeum, Budapest.
ZM	Zoologisk Museum, Copenhagen.

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Host-plant relationships within *Mirificarma*

Gelechiid genera are often associated with particular host-plant groups, for example, *Ornativalva* Gozmány – *Tamarix, Caryocolum* Gregor & Povolný – Caryophyllaceae. The known host-plants of *Mirificarma* larvae are all Leguminosae. It is sometimes difficult to verify host-plant records since the plant or the moth may have been misidentified; for example, an erroneous record of *eburnella* on *Populus* is based on a misidentification of the moth, which was probably *Schiffermuelleria formosella* ([Denis & Schiffermüller]). Additionally, changes in botanical nomenclature can cause problems, such as the following examples. *Cytisus scoparius* L. was known as *Spartium scoparium* by some authors and records of *Spartium* probably refer to this plant and not to species currently in *Spartium. Trifolium* has been used broadly to cover plants in other genera of the Trifolieae such as *Medicago*. Some 'host-plant' records are not based on moths bred from larvae on the plant, but merely on the circumstantial evidence of the presence of the moths around the plant, and may be erroneous. Such errors are often compounded by one author copying another without providing confirmatory data or citing the source of information.

The choice of host-plant does not seem to reflect the systematic relationships of *Mirificarma* within the Gelechiidae. Leguminosae are utilized as larval host-plants by species in several unrelated groups of the Gelechiidae, for example, *Xystophora* Heinemann (Aristoteliinae), *Syncopacma* Meyrick (Anacampsinae), *Dichomeris* Hübner (Dichomerinae) and *Anarsia* Zeller (Chelariinae). In the Gelechiinae, Leguminosae are known as host-plants of several unrelated species in the tribe Gelechiini, including *Lita solutella* (Zeller), *Chionodes lugubrella* (Fabricius) and *Aroga aristotelis* Millière. Species of *Gelechia* Hübner, the apparent close relative of *Mirificarma,* utilize a diverse range of host-plants, predominantly Salicaceae, *Juniperus* and Rosaceae.

The host-plants of 11 species of *Mirificarma* are known and are all in the subfamily Papilionoideae. The systematics of the Leguminosae are taken from Polhill & Raven (1981). The Papilionoideae are divided into several groupings of tribes including the epulvinate series, which comprises the temperate herbaceous tribes, which have lost the basal pulvinus of the leaf, and the genistoid alliance, which includes the tribe Genisteae. Four species of *Mirificarma* have, as yet, been recorded from only one host-plant, but seven species have been bred from two or more plant species and *eburnella* and *mulinella* are each known from seven.

Three species-groups are here recognized in *Mirificarma* based on a number of morphological

Table 1 Checklist of the species and subspecies of *Mirificarma*, with host-plant data.

Species and subspecies of *Mirificarma*	Host-plants of *Mirificarma* larvae Leguminosae: Papilionoideae	
	tribes of the epulvinate series	tribe Genisteae
MIRIFICARMA Gozmány, 1955		
Helina Guenée, 1849 [junior homonym]		
***montivaga*-group**		
montivaga (Walsingham, 1904) **comb. n.**		
pulverosella (Zerny, 1936) **syn. n.**		
***maculatella*-group**		
scissella (Chrétien, 1915) **comb. n.**		
rhodoptera (Mann, 1866)		
***denotata* sp. n.**	Galegeae: *Astragalus*	
maculatella (Hübner, 1796)	Coronilleae: *Coronilla*	
pallidipulchra (Walsingham, 1904) **comb. n.**		
striolella (Turati, 1924) **syn. n.**		
aflavella (Amsel, 1935) **stat. n.**		
flavella (Duponchel, [1844])	Trifolieae: *Trifolium* Loteae: *Lotus*	
segetella (Zeller, 1847)		
eburnella ([Denis & Schiffermüller], 1775) **comb. n.**	Trifolieae: *Medicago* : *Trifolium* Vicieae: *Vicia* Coronilleae: *Hippocrepis*	
formosella (Hübner, 1796) [junior homonym]		
flammella (Hübner, [1825])		
rufeoformosella (Bruand d'Uzelle, 1859)		
***interuptella*-group**		
ocellinella (Chrétien, 1915) **comb. n.**		*Retama*
aurantiella (Chrétien, 1915) **syn. n.**		
retamaeofoliella (Dumont, 1931) **syn. n.**		
***fasciata* sp. n.**		
lentiginosella (Zeller, 1839)		*Genista*, *Laburnum*
***constricta* sp. n.**		
cytisella cytisella (Treitschke, 1833)	Trifolieae: *Ononis*	*Cytisus*, *Genista*, *Calicotome*, *Laburnum*
cytisella leonella Amsel, 1959		
monticolella (Rebel, 1931) **comb. n., stat. n.**		
interuptella (Hübner, 1793)		*Cytisus*, *Genista*
flavonigrella (Chrétien, 1915) **comb. n.**		
burdonella (Rebel, 1930)		
cabezella (Chrétien, 1925)		*Adenocarpus*
ulicinella (Staudinger, 1859)		*Ulex*
mulinella (Zeller, 1839)		*Ulex*, *Cytisus*, *Genista*, *Calicotome*, *Lupinus*
caminariella (Fuchs, 1902)		
nigraesilvae (Amsel, 1950)		

characters. The division of the two major species-groups is corroborated by host-plant differences. Host-plants of the *montivaga*-group are unknown. The host-plants of the *maculatella*-group are all in the epulvinate series, in the tribes Loteae, Coronilleae, Trifolieae, Vicieae and Galegeae, while the *interuptella*-group has Genisteae host-plants (see Table 1).

One species in the *interuptella*-group, *cytisella*, has *Ononis* as a host-plant, in addition to several species of Genisteae. Although *Ononis* is a member of the Trifolieae, it has some Genisteae-like morphological characters and it has been linked with the Genisteae by early authors (see the discussion of the taxonomic history of *Ononis* by Kupicha, 1977: 134). *Ononis* also has biochemical affinities with the Genisteae, to which it has similar isoflavenoids (see Gomes *et alii*, 1981: 472, 473). It is possible that these characteristics make the plant acceptable to the moth which otherwise selects Genisteae. In addition the host-plant must be acceptable to the larva.

Although *Mirificarma* species within a species-group share host-plants of the same tribe or group of tribes, there is little evidence that the close relationship of species is reflected in the close relationship of their host-plants. In the *maculatella*-group, *eburnella* and *flavella* both occur mainly on Trifolieae, including *Trifolium*. However, *eburnella* also occurs on Coronilleae, the host-plant tribe of *maculatella*, a species to which *eburnella* is less closely related. *M. maculatella* and its sister-species *denotata* use plants of different tribes, Coronilleae and Galegeae respectively.

In the *interuptella*-group, the closely related *mulinella* and *ulicinella* both occur on *Ulex,* although on different species, but *mulinella* shares *Cytisus nigricans, Calicotome spinosa* and *Genista* with *cytisella*; *Genista germanica* and *G. tinctoria* with *lentiginosella*, and *Cytisus scoparius* with *interuptella. M. mulinella* and *ulicinella* form a close group with *cabezella* which differs considerably from these two in its host-plant *Adenocarpus*, an outlier in the Genisteae.

The distribution of a host-plant has not always restricted the distribution of the moth, which may have adapted to different plants in different parts of its range. For example, *cytisella* was described from specimens bred on *Cytisus nigricans* in Germany, and has subsequently been bred on this, for example, by Klimesch (1961: 651) in Austria. *C. nigricans* does not occur in France (Tutin *et alii*, 1968: 86) and *cytisella* has been recorded there on *Calicotome* and *Ononis*. The ability of some *Mirificarma* species to utilize a range of host-plant genera suggests that they have adapted to different hosts rather than that they have evolved in conjunction with their hosts.

The systematic position of *Mirificarma*

Many species currently in *Mirificarma* were originally described in *Gelechia*, and subsequently listed in this genus by Gaede (1937). However, *Gelechia* has been widely used to include many unrelated species and has been referred to as the microlepidopterist's 'waste-paper box' (Chambers, 1872: 147, and subsequent authors). *Mirificarma* is clearly separated from *Gelechia* (sensu Sattler, 1960) by the presence of a filament on the male genitalia, as well as other characters (see also remarks, p. 15).

Following the original placing of *flavella* in *Acompsia* Hübner, the related species *eburnella* (as *formosella* Hübner) and *pallidipulchra* were also listed in this genus by Meyrick (1925: 142) and Gaede (1937), possibly because *Acompsia* and *Mirificarma* have similar wing venation. *Acompsia* and *Mirificarma* differ, however, in many characters including the male eighth tergite and sternite which are laterally fused in the former but separated in the latter. The three species have also been placed in *Rhinosia* Treitschke, either in the original descriptions or by subsequent authors including Meess (*in* Spuler, 1910: 344), apparently because of a strong superficial similarity to species then in *Rhinosia* but now transferred to *Orophia* Hübner (Oecophoridae). *Orophia ferrugella* ([Denis & Schiffermüller]), formerly in *Rhinosia*, has sometimes been misidentified as *flavella* (see p. 27).

In the original description, *Mirificarma* was placed between *Neofaculta* Gozmány and *Lita* Treitschke, both currently in the subfamily Gelechiinae, without indication as to whether its position was deliberate or arbitrary. Sattler (1960: 41) also placed it among genera currently in the Gelechiinae although its placement between *Lita* and *Aroga* Busck was arbitrary.

The subfamilies of Gelechiidae are mostly poorly defined and the relationships of the genera still require much investigation. However, *Mirificarma* does appear to share some characters with certain other genera within the Gelechiidae. The eighth abdominal tergite and sternite of the male are separated into free flaps in *Mirificarma*. This is usual in the Gelechiinae (tribes Gelechiini, Teleiodini and Gnorimoschemini) whereas the tergite and sternite are normally fused laterally in the rest of the Gelechiidae. The long narrow scales of the coremata of the eighth tergite of *Mirificarma* are similarly placed to those occurring in many Gelechiinae, attached closely to the tergite. Coremata occur in a few genera outside the Gelechiinae, and are probably homologous in some cases, such as in *Deltophora* Janse in the Aristoteliinae, although in this genus the coremata are usually loosely attached to the tergite. The coremata of the male eighth sternite of *Mirificarma*, on the dorsal membrane, consist of enlarged scales with a rounded, often inflated structure. Some Gelechiinae have scales similarly situated, as seen in *Gelechia scotinella* Herrich-Schäffer, *G. hippophaella* (Schrank), *G. nigra* (Haworth) and *Teleiodes myricariella* (Frey), in which the scales are large and sometimes long although not inflated. The scales are deciduous, consequently fresh preparations need to be made to assess how widespread they might be in the Gelechiinae and whether they might occur outside the Gelechiinae. The scales are most similar to those of *Mirificarma* in *Psoricoptera gibbosella* (Zeller), currently in the Hypatiminae although with a number of similarities to *Gelechia* near which it might be better placed.

In common with many Gelechiinae, the posterior apophyses of the female genitalia are often long in *Mirificarma*, although this character is not restricted to this subfamily.

Within the Gelechiinae, *Mirificarma* does not appear to be closely related to the Gnorimoschemini, in which the signum of the female genitalia is a strong hook-like structure. The signum of *Mirificarma* varies interspecifically but is never of this form. *M. montivaga*, which has the least apomorphies of the genus, has a signum similar to that frequently seen in *Gelechia* and the Teleiodini. This type of signum is also found in *Neofriseria* Sattler, currently placed in the Gelechiini although not in close relationship with *Gelechia*, and *Psoricoptera gibbosella*, currently in the Hypatiminae although, as mentioned above, probably more closely related to *Gelechia*. *Mirificarma* does not show evidence of a close relationship with the Teleiodini, in which the male genitalia have frequent modifications not shared by *Mirificarma*, such as a narrow, elongate uncus. The male eighth segment varies in shape in the Teleiodini and usually differs from that of *Mirificarma*. The gnathos is absent in some Teleiodini and if present, usually also differs from that of *Mirificarma*.

The possession of a filament on the male genitalia distinguishes *Mirificarma* from all other Gelechiidae. However, the pair of sclerites which support the filament in *Mirificarma*, extending anteriorly from the base of the sacculus and valva and lying between the vinculum and tegumen, appear to be homologous with similar structures in species of *Gelechia*, particularly *G. sabinella* Zeller, *G. nigra, G. rhombella* ([Denis & Schiffermüller]) and *G. senticetella* Staudinger. The sclerites in these species are fused anteriorly, at the region from which the filament would arise in *Mirificarma*. This region is usually membraneous in *Gelechia*, and never a well-sclerotized swelling as in *montivaga* which has the least-developed filament of *Mirificarma*. A membraneous sac is present around the filament and supporting sclerites of *Mirificarma* and this is sometimes also present around the sclerites of *Gelechia*. Slight sclerotized extensions from the base of the sacculus or valva may occur in other genera, such as *Chionodes* Hübner, but it is the development of these into the long sclerites that appears to be a synapomorphy of *Mirificarma* and *Gelechia*.

Thus I consider *Mirificarma* to belong in the Gelechiinae, as delimited above, on account of the structure of the male eighth abdominal segment. Within this subfamily I consider it to be close to *Gelechia*, with which it shares the presence of the sclerites described above.

Classification of *Mirificarma* species

The cladogram (Fig. 2) is based on the list of characters (Table 2) of *Mirificarma* and its presumed close relative *Gelechia*. Further material of *Mirificarma* and related genera would be

montivaga								▨																															▨						▨
scissella	■	—	■				—		■				—	—			—	—					—					—	—		—			—	—		▨		—	—					—
rhodoptera	■	▨	▨																																■	■	▨		▨						▨
denotata	■	▨	■						■																									■	—	■	■			▨	■				
maculatella	■	■	■										▨																						■	■	■				■				▨
pallidipulchra	■	■	▨																																■	■	■	■	■						
aflavella	■	■	■						■																										■	■	■	■	■						
flavella	■	■	■					▨																		▨									■	■	■	■	▨	■					
eburnella	■	■	■					▨																										▨	—	■	▨	■		■					
ocellinella	■	■	■	■	▨	■	■	■	■	■	■	■	■	■	■	■																			▨				▨			■		■	▨
fasciata	■	■	■	■	▨	■	■	■	■	■	■	■	■	■	■	■																							▨			■	■	■	▨
lentiginosella	■	■	■	■	▨	■	■	■	■					■	▨	▨	■	▨	▨	■	■	■																							
constricta	■	—	■	■	■	■	—	■	■				—	—			—	—	▨	■	■	■	—					—	—		—			—	—				—	—					—
cytisella	■	■	■	■	■	■	■	■	■								■	▨	▨				■	■	■																				■
monticolella	■	—	■	■	■	■	—	■	■				—	—			—	—	■				—	■	■	■		—	—		—			—	—				—	—				■	—
interuptella	■	■	■	■	■	■	■	■	■								■	■	■		▨	▨	■			■	■	■	■													■		■	
flavonigrella	■	—	■	■	■	■	—	■	■				—	—			—	—	■				—	■	■	■	■	—	—	■	—			—	—				—	—		■			—
burdonella	■	■	■	■	■	■	■	■	■								■	■	■				■	■	■	■	■	■	■	■				■	—							■			▨
cabezella	■	■	■	■	■	■	■	■	■								■	■	■												■	■	■	■	—										■
ulicinella	■	■	■	■	■	■	■	■	■								■	■	■												■	■	■1	■	—								■		■
mulinella	■	■	■	■	■	■	■	■	■								■	■	■												■	■	■1	■	—							■		■	■
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45

Fig. 1 Character matrix for the species of *Mirificarma*. The numbers along the bottom row refer to characters listed in Table 2. Black squares denote presumed apomorphies, numbered black squares denote a further development of character 33, shaded squares denote intermediate character states, dashes denote character state unknown. Character 35 is inapplicable to species without a signum, which are also indicated by a dash.

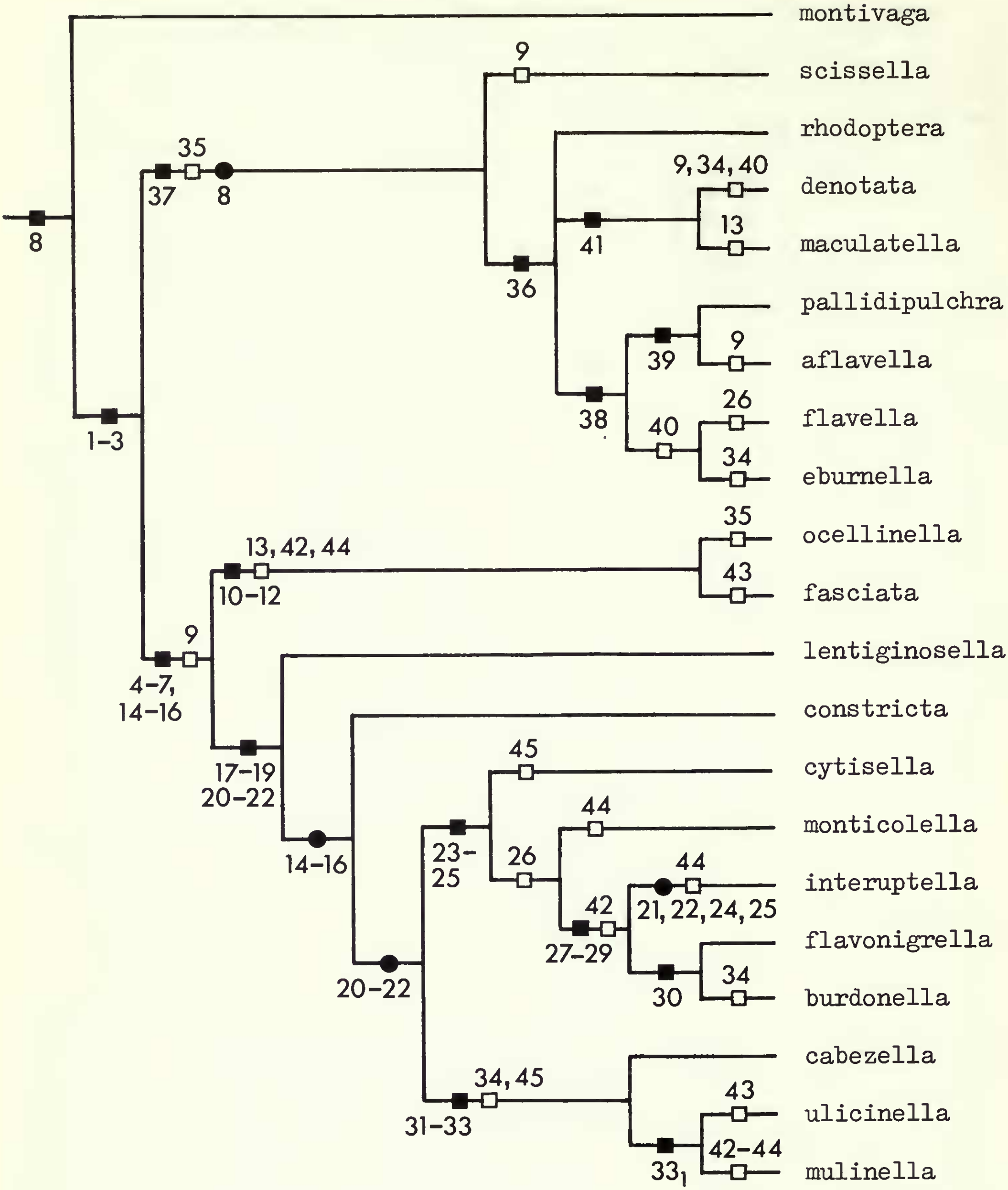


Fig. 2 Cladogram derived from the character matrix for the species of *Mirificarma*. Numbers refer to characters listed in Table 2. Black squares (with numbers below) denote presumed apomorphies, open squares (with numbers above) denote presumed convergences, black circles (with numbers below) denote presumed character-reversals.

required to resolve fully the relationships within *Mirificarma*. Autapomorphies of individual species are not included except where they are presumed to involve character-reversal or convergence. The females of four species are unknown. Intermediate states are scored as apomorphies, with the exception of those discussed in the additional comments on characters 39 and 45. Apparent convergences occur in characters 9, 13, 14, 21, 22, 26, 34, 35, 40, 42–45.

Polarities of characters have been estimated by comparison with the out-group (*Gelechia* and other Gelechiinae), but this has not always been possible and therefore the polarities of some character states are dubious.

From the analysis of the characters examined (Figs 1, 2) *montivaga* has the least apomorphies of the genus, since it is plesiomorphic in characters 1–3, whereas these are apomorphic in all other species of *Mirificarma*. These other species can be divided into two groups, the *maculatella*-group and the *interuptella*-group. The *interuptella*-group is defined by the apomorphic states of characters 4–7 and 14–16, although the last three characters are reversed in some species (see Figs 1, 2). The *maculatella*-group is defined by the apomorphy of character 37 and the reversal of 8. The division of the two species-groups is corroborated by their host-plant relationships (see p. 5).

Within the *maculatella*-group, the relationships of *rhodoptera* are not fully resolved, hence the trichotomy in Fig. 2. In order to resolve the relationships within the *interuptella*-group, reversal of characters 14–16, 20–22, 24 and 25 has been presumed.

The 'Remarks' on each species that follow (p. 19 onwards) reflect the primary concern of this paper, namely species diagnosis and therefore stress similarities and differences between species but do not necessarily indicate their relationships.

Table 2 Characters used in the construction of a cladogram for *Mirificarma*.

Character	State	
	Plesiomorphic	Apomorphic
1 Male filament	very weakly developed	well developed
2 Ductus bursae	extremely long	comparatively short
3 Aedeagus	bulbous in basal half	uniformly slender
4 Vinculum	without sclerites extending from saccus, although sometimes with short faint sclerites extending from anterior margin of vinculum (sclerites of *montivaga* are more similar to this than to the apomorphic state)	with pair of sclerites or single sclerite extending from saccus towards hind edge of vinculum
5 Uncus	large, slightly narrower than tegumen	small, usually considerably narrower than tegumen (small but narrowing evenly from tegumen in *monticolella*)
6 Tegumen lateral margins	with pair of small rounded processes (often weak in *montivaga*)	comparatively even
7 Membrane between papillae anales and eighth abdominal segment of female	with two invaginations	with single invagination
8 Hind edge of vinculum	broadly projecting but without distinctly demarcated median projection	with distinctly demarcated median projection, usually comparatively narrow, or hind edge a narrow projection
9 Hind wing veins *Rs* and M_1	separate	on common stalk
10 Sacculus	broad, at least basally [this character has four apomorphic states – see also 20, 26, 33]	moderately slender, straight or slightly curved, with one or more small irregular projections at apex

Table 2 – *Continued*

Character	State	
	Plesiomorphic	Apomorphic
11 Median projection of hind edge of vinculum	not sharply rectangular	sharply rectangular, scarcely emarginate, membraneous
12 Projection near apex of aedeagus	relatively broad [this character has three apomorphic states – see also 32, 37]	slight, very narrow, distinctly sclerotized
13 Pair of membraneous sacs between apophyses anteriores and antrum	absent	present
14 Antrum	comparatively short	extremely long
15 Saccus	short or moderately long	extremely long
16 Aedeagus/tegumen length ratio	low (at most 1·3)	high (1·7–1·8)
17 Apophyses anteriores	long (at least 0·6 mm)	short (less than 0·6 mm)
18 Female eighth abdominal segment	slightly sclerotized	well sclerotized (either uniformly, or with patches of very strong sclerotization)
19 Filament extent	far beyond hind edge of vinculum	at most a comparatively short distance beyond hind edge of vinculum
20 Sacculus	broad, at least basally [this character has four apomorphic states – see also 10, 26, 33]	slender, moderately curved, with even apex
21 Uncus	not or scarcely constricted at base	constricted at base (more so in *constricta* than in *lentiginosella*)
22 Filament	gently curved, slightly helical or straight [this character has two apomorphic states – see also 30]	with apical half kinked, basal half straight
23 Patch of sclerotization at posterior margin of female seventh abdominal segment	faint, diffuse, merging with median longitudinal band or absent	well defined
24 Gnathos	a large hook, or complex	small simple hook-shape
25 Uncus	broad or not narrowing from base towards apex	small and narrowing from base towards apex
26 Sacculus	not stouter apically [this character has four apomorphic states – see also 10, 20, 33]	stouter towards apex (club-shaped or slender and spatulate)
27 Aedeagus apex	not cylindrical	almost cylindrical
28 Apophyses anteriores	rod-like	lobe-like
29 Female eighth sternite	without strongly contrasting areas of sclerotization	strongly sclerotized laterally, contrasting with weakly sclerotized median area
30 Filament	narrowing evenly towards apex [this character has two apomorphic states – see also 22]	with basal half dorsoventrally expanded and laterally compressed

31 Posterior margin of female seventh abdominal segment	with, at most, diffuse band of scales	with distinct, dense band of scales
32 Projection near apex of aedeagus	small, sclerotized, evenly tapering [this character has three apomorphic states – see also 12, 37]	weakly sclerotized, rounded
33 Sacculus	broad, at least basally [this character has four apomorphic states – see also 10, 20, 26]	evenly slender, straight and smooth (the particularly slender sacculus of *mulinella* and *ulicinella* represents a further development – 33_1)
34 Signum	present	absent
35 Signum	with very many small spines or without spines	with large spines (small spines sometimes also present)
36 Filament-supporting sclerites	not twisted	twisted (weakly twisted in *flavella*)
37 Projection near apex of aedeagus	small, evenly tapering [this character has three apomorphic states – see also 12, 32]	large, angular, hooked, narrowing to a point
38 Fore wing pattern	small spots or uniform [this character has three apomorphic states – see also 41, 42]	zig-zag yellowish markings
39 Median longitudinal band of sclerotization of female seventh abdominal segment	if present, not or slightly constricted	strongly constricted
40 Antrum	curved or constricted towards apex	straight and not constricted towards apex
41 Fore wing pattern	small spots or uniform [this character has three apomorphic states – see also 38, 42]	large spots
42 Fore wing pattern	small spots or uniform [this character has three apomorphic states – see also 38, 41]	median longitudinal stripe (broken or unbroken)
43 Gnathos	curved	almost straight (short in *ulicinella,* long in *fasciata*)
44 Saccus	broad, at least basally	relatively slender
45 Female frenulum	three setae	usually two setae

Additional comments on the characters listed in Table 2

5 *M. ocellinella* and *fasciata* are intermediate, more similar to the plesiomorphic than to the apomorphic state.

8 *M. montivaga* is classed as intermediate since the hind edge of the vinculum sometimes approaches the apomorphic state.

9 This character is not very reliable since both states are found in some species, although one state is always greatly predominant.

16 Aedeagus/tegumen length ratio is intermediate in *lentiginosella* (1·4–1·5).

18 This character is difficult to observe (since the sclerotization is more obvious in well-stained specimens) but trends of difference between species can be observed. *M. montivaga* has the

least sclerotization. *M. lentiginosella* and *cytisella* have larger areas of sclerotization than in species with the plesiomorphic state but smaller areas or weaker sclerotization than in the other species with the apomorphic state.

19 The species with the longest filaments of the apomorphic state, in relation to tegumen length, are marked as intermediate.

21 *M. interuptella* is intermediate between the two states, with the base of the uncus constricted, usually slightly, in a minority of specimens.

22 *M. interuptella* is marked as intermediate since the filament is kinked throughout its length.

26 The saccus of *flavella* is occasionally stouter apically but is usually more uniformly stout than in the apomorphic state.

35 It is impossible to assess this character in *denotata* and the other species in which the signum is absent, or in *eburnella* which has a barely discernible signum.

37 The aedeagus projection of *montivaga* (plesiomorphic state) is always small in relation to aedeagus width. *M. rhodoptera* and *eburnella* are intermediate with an aedeagus projection of the derived shape but small. *M. scissella* is intermediate with a more rounded projection than the derived state.

39 The derived state is not to be confused with the slight constriction of the band of sclerotization in the several species marked as intermediate and not scored on the cladogram.

40 *M. denotata* is classed as intermediate since its antrum narrows towards the apex more than that of *flavella* and *eburnella*. It is not appropriate to score this character in species with an extremely short antrum.

42 In the species marked as intermediate both states are present in different specimens.

45 Too few specimens have been examined to be certain of the character state of every species, since this character is sometimes very variable intraspecifically. As this character is unstable, only the species which usually have two setae are scored as apomorphic. Species with an equal occurrence of two and three setae or with a tendency towards three setae are classed as intermediate and are not scored on the cladogram. This character seems to show a trend towards a relationship between *mulinella, ulicinella* and *cabezella*, which have the apomorphic state, although this is also shared by *cytisella*.

The structure of the filament of the male genitalia

In his original description of *Mirificarma*, Gozmány referred to the filament as 'a very long filamental prong' accompanying the aedeagus. It is orientated longitudinally and is near to the aedeagus in the undissected genitalia, but it has no physical connection with the aedeagus. The aedeagus lies between the ventral surface and the dorsal membrane of the vinculum, whereas the filament is more dorsal, lying between the dorsal membrane of the vinculum and the tegumen. Sattler (1960: 41) compared the filament of *Mirificarma* with processes of the transtilla in *Bryotropha* Heinemann and *Filatima* Busck, but these structures are not homologous with the filament.

The filament is very weakly developed in *montivaga*, in which it is merely a slight sclerotized swelling where the supporting sclerites meet. In all other *Mirificarma* species it is a long, well-sclerotized tube, usually cylindrical, although narrowing gradually, posteriorly, and usually very narrow at the posterior end; usually gently curved or, if very long, sometimes slightly helical. Ocasionally the filament is straight, as in *ocellinella*, or modified in shape, for example with a strong kink near the apex in *lentiginosella* and with a projecting lobe in *constricta* and *ulicinella*. The filament varies in length between species, being shortest in relation to tegumen length in *flavonigrella* and *ulicinella*. In the latter, the filament does not usually reach the anterior of the tegumen and extends posteriorly only as far as the hind edge of the vinculum. The filament is longest in relation to tegumen length in *pallidipulchra*, in which it extends very far beyond the anterior of the tegumen and extends posteriorly beyond the uncus.

The filament is open anteriorly and has a small opening near the posterior end. This opening is almost terminal in *flavella* and *ocellinella* whereas it is situated further from the posterior in *maculatella* and *cabezella*. In *scissella* a second tiny posterior opening is present. In *ocellinella* and *denotata* a tiny projection occurs from the posterior opening of the filament. In *maculatella* a similar projection is situated more posteriorly. The filament surface of all species appears smooth except for occasional minute spines.

The filament arises from a pair of lateral sclerotized strips, referred to here as filament-supporting sclerites. These extend from the base of the sacculus and, to a less extent, the valva, and meet anteriorly, at which point they fuse to form the filament. The filament is attached only at its anterior, and the length of the sclerites thus varies with the anterior extent of the filament. In many species the filament-supporting sclerites appear to be a smooth continuation of the sacculus. The sclerites are usually parallel-sided over much of their length, at least in the species in which they are long, but they are widened, often considerably and irregularly, towards the sacculus and valva. This expanded area of the sclerite is often faintly rugose and may represent an area of muscle attachment. This feature is not confined to *Mirificarma* since similarly placed, although even fainter, rugose patches are present in *Gelechia nigra*. The filament-supporting sclerites of *Mirificarma* are widened anteriorly, where they meet.

The filament and supporting sclerites are covered ventrally by a membraneous sac which is attached to the sclerites and the anterior end of the filament. The sclerites are spiralled round each other in some species and in these the membrane is similarly twisted. A membraneous sac is usually also present dorsally, from the tegumen. These membranes are flimsy and the dorsal membrane in particular tends to disintegrate during the preparation of genitalia slides. The dorsal membrane is relatively well developed in *cabezella* and *mulinella*, for example, but it is most obvious in *ulicinella*.

The function of the filament is unknown. There is some correlation between its length and that of the female apophyses anteriores. There appears to be no correlation between the length of the filament and that of the aedeagus such as the correlation discussed between the saccus and the aedeagus (see p. 15).

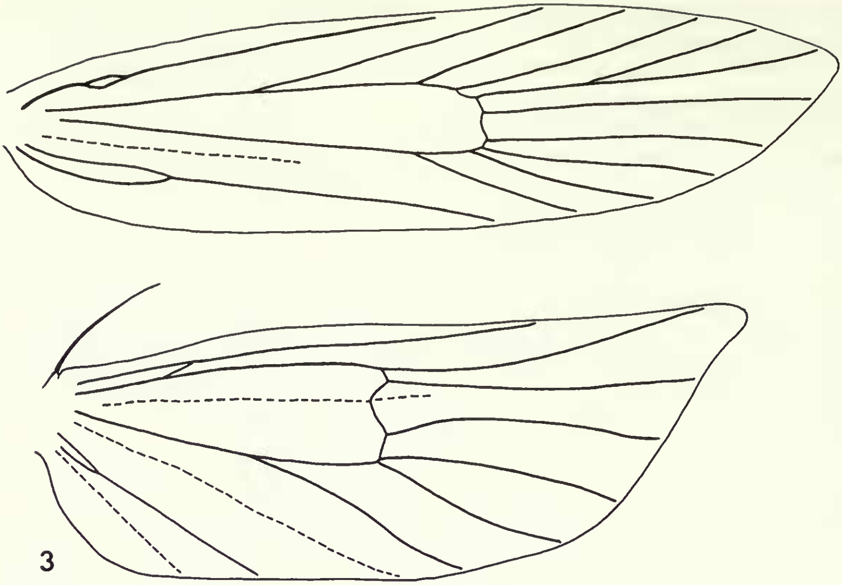
MIRIFICARMA Gozmány

Helina Guenée, 1849: 411. Type-species: *Carcina flammella* Hübner, [1825], by monotypy. [Junior homonym of *Helina* Robineau-Desvoidy, 1830 (Diptera).]

Mirificarma Gozmány, 1955: 308, 309 [keys], 313. Type-species: *Tinea maculatella* Hübner, 1796, by original designation.

♂, ♀. (4·5) 5·0–11·0 mm. Head without frontal modifications. Ocellus present. Proboscis well developed; squamose, particularly at base. Maxillary palpus with four segments. Labial palpus recurved, first segment much shorter than second; third segment approximately same length as second or, rarely, slightly shorter; second segment without brush below or, rarely, with slight to moderate brush. Antenna without pecten on scape. Metascutum with paired group of narrow hair-like scales. Fore wing sometimes with zig-zag pattern of yellowish markings; sometimes with large or small dark spot across fold and another at end of cell; sometimes with dark, median, longitudinal, broken or unbroken stripe; a few species without any of these patterns. Fore wing with veins R_4 and R_5 on long common stalk (Fig. 3); distance R_1–R_2 slightly greater than, to four times R_2–R_3; M_3 and Cu_1 separate. Hind wing with veins Rs and M_1 on common stalk or separate (Figs 3, 4). Frenulum of female with three or sometimes two long setae.

GENITALIA ♂. Eighth tergite and sternite separated into free flaps. Eightn tergite with pair of coremata consisting of dense brushes of long, thin, hair-like scales, inserted laterally at anterior of tergite and attached to ventral membrane of tergite. Dorsal membrane of sternite with coremata consisting of two groups of large, rounded, often inflated, grape-like scales covering most of sternite. Genitalia withdrawn inside eighth segment. Uncus rounded, often large. Gnathos well-sclerotized, usually simple hook. Gnathos base with small membraneous area densely covered with microtrichia. Tegumen with or without lateral pair of rounded processes. Anterior margin of tegumen with deep V- or occasionally U-shaped emargination. Valva long, usually reaching uncus, slender, simple, slightly swollen at rounded apex. Sacculus clearly separated from valva. Long pair of sclerotized strips present, extending from base of valva and sacculus and meeting anteriorly. Long sclerotized tube (filament) present, arising from where pair of sclerotized strips join; extending posteriorly. In *montivaga*, filament extremely small; merely slight swelling of sclerotization. Hind edge of vinculum usually with medially emarginate median projection. Vinculum extends far posteriorly, hind edge reaching anterior of gnathos in a few species. Vinculum with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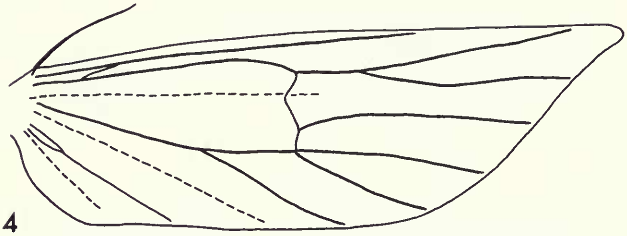
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Figs 3, 4 Wing venation of *Mirificarma* species, ♂. 3, *M. maculatella* (Hübner). 4, hind wing of *M. interuptella* (Hübner).

or without pair of narrow sclerites or, exceptionally, single narrow sclerite, extending from saccus towards hind edge of vinculum. Saccus ranging from very slight projection to extremely long. Aedeagus usually cylindrical, slender; occasionally inflated basally; without cornuti. Projection near apex of aedeagus ranging from scarcely discernible to large, hook-like. Anterior part of ductus ejaculatorius often with sclerotized lamina.

Genitalia. ♀. Dorsal and ventral abdominal surfaces sometimes form broad, median, longitudinal sclerotized band. Posterior margin of seventh segment sometimes with more strongly sclerotized patches. Anterior margin of seventh sternite usually unmodified but in one species (*pallidipulchra*) with pair of sclerites and membraneous sac. Papilla analis usually longer than broad. Invagination of membrane between eighth tergite and papillae anales usually present, immediately opposite invagination, sometimes present, of membrane between sternite and papillae anales. Eighth segment with predominantly lateral areas of sclerotization; occasionally almost completely sclerotized. Apophysis anterior usually rod-like, occasionally short, broad lobe; length 0·2–1·3 mm; apophysis posterior two to six times length of apophysis anterior in each species. Sclerotized antrum present, usually long, nearly as long as apophysis anterior to much longer; occasionally extremely short. Ductus bursae often much shorter than corpus bursae, sometimes longer, exceptionally six times length of corpus bursae. Ductus seminalis arises from posterior part of ductus bursae, usually very near antrum. Corpus bursae with minute spines on inner surface sometimes sparse, sometimes extending into ductus bursae. Corpus bursae with or without signum. Signum, if present, usually oval or round, usually spinose; spines, if present, directed inside corpus bursae; signum sometimes curved inwards, never hook-like.

REMARKS. The fore wing venation of *Mirificarma* has been checked in nine specimens and is similar to that of many Gelechiidae but appears to differ from that of many *Gelechia* species. In *Mirificarma* the fore wing veins M_3 and Cu_1 are separate whereas these are frequently on a common stalk in *Gelechia*.

The coremata of the male eighth abdominal segment of *Mirificarma* are readily lost during the preparation of genitalia slides although the scale bases can still be seen. The membraneous area of the base of the gnathos is much smaller in *Mirificarma* than in *Gelechia* and the Gnorimoschemini in both of which it is an extensive sac. This structure is seen in some genera outside the Gelechiinae, for example *Dichomeris* Hübner and *Acompsia*. The strongly sclerotized hook-shaped gnathos usual in *Mirificarma* occurs in various Gelechiidae but not in *Gelechia*. *Mirificarma* is distinguished by the presence of the filament of the male genitalia (see also the discussions on pp. 5, 6).

The narrow sclerites of the vinculum which extend from the saccus towards the hind edge of the vinculum in the *interuptella*-group of *Mirificarma* are not usually present in the Gelechiidae, although they occur in *Psoricoptera gibbosella* which may be related to *Gelechia* and *Mirificarma* (see p. 6). In the *maculatella*-group the sclerotized anterior margin of the vinculum is occasionally continued towards the median across the posterior of the saccus as a pair of very faint short sclerites. Similar, though longer and very distinct, sclerites occur in the Gnorimoschemini. These sclerites, unlike those of the *interuptella*-group, do not appear to arise from the saccus itself. The vinculum in *Mirificarma* is longest in *interuptella*, sometimes almost reaching the gnathos base of this species.

The aedeagus is usually more slender than in *Gelechia*. There appears to be some correlation between the length of the saccus and the aedeagus in *Mirificarma*. In relation to the tegumen length, these structures are both exceptionally long in *ocellinella* and *fasciata*; in *lentiginosella* they are slightly shorter, although still longer than in the remaining *Mirificarma* species. The saccus is shortest in *rhodoptera* and in this species the aedeagus is also the shortest. In the species with the longest saccus the aedeagus exceeds 1·5 times the length of the tegumen and the sclerotized saccus may serve to support the aedeagus where it extends beyond the tegumen anteriorly. The aedeagus is attached to the anterior of the saccus by retractor muscles in the representative of the Gelechiidae examined by Kuznetsov & Stekol'nikov (1978: 131) and there is a similarly attached muscle in *Mirificarma fasciata*.

Sattler (1976: 93) mentions an apparent correlation between the length of the ductus ejaculatorius of the male and the ductus bursae of the female in the species of *Ornativalva* Gozmány, currently in the Gelechiini, in which these structures are exceptionally long. Likewise, in *Mirificarma*, the ductus ejaculatorius and the ductus bursae are both considerably longer in *montivaga* than in the rest of the genus. There is no obvious correlation in the other *Mirificarma* species, in which both structures are shorter.

Mirificarma species with slight sclerotization of the female eighth sternite often have membraneous areas between the apophyses anteriores and the antrum, although the apophyses anteriores and the lateral margins of the antrum are usually continued into the sternite as narrow sclerites, reaching the sclerotized areas of the sternite. In *montivaga* there is little sclerotization of the sternite other than the continuation of the apophyses anteriores. The longitudinal band of the female abdomen in some species of *Mirificarma* is faint and is best observed in well-stained, freshly prepared specimens. I have included this feature in the species diagnoses only when it is characteristic. The band is also present in the male but is less useful as a character for species diagnosis.

The sclerotized antrum of *Mirificarma* is usually long, whereas it is usually very short if present in *Gelechia*. Most *Mirificarma* species have a rounded, spinose signum. Only *montivaga* has a signum of the type common in *Gelechia*, diamond-shaped with a pair of serrated-edged ridges.

BIOLOGY. The known host-plants of *Mirificarma* are all Leguminosae and are discussed under each species and in the section on host-plant relationships. Although most of the species of *Mirificarma* are not known to have any economic significance, *eburnella* has been reported as an agricultural pest in the U.S.A., where it damages clover crops (see p. 28).

The egg stage and site of egg deposition on the host-plant are unknown. The larva makes a spinning amongst the leaves of the host-plant or feeds in the shoots. In plants with small leaves, such as *Ulex*, the larva usually feeds in the flowers. Where details are known, pupation usually takes place in a slight cocoon amongst fallen leaves on the ground, although *eburnella* is recorded as pupating between the leaves on the host-plant. There are few records of the number of generations per year; two species are reputed to have only one generation but two are recorded for *eburnella*. Species may breed continuously where climatic conditions permit as is suggested by the wide range of dates on which *ocellinella* has been collected.

DISTRIBUTION. *Mirificarma* species are distributed in the Palaearctic region between 55° N and 30° S, extending east to *c.*45°. One species, *eburnella*, also occurs in the U.S.A., where it has been introduced.

Key to the species of *Mirificarma*

Males

1 Fore wing with large dark spots (Figs 9, 10) 2
– Fore wing with small dark spots or different markings 3
2 Fore wing with large dark spot across fold narrowing gradually from middle towards costa; spot at end of cell comparatively distinct from patch at costa (Fig. 10). Portion of aedeagus apical to hook large (Fig. 65) .... **maculatella** (p. 23)
– Fore wing with large dark spot across fold narrowing sharply from middle towards costa; spot at end of cell merging with patch at costa (Fig. 9). Portion of aedeagus apical to hook small (Fig. 64) .... **denotata** (p. 22)
3 Filament scarcely discernible (Fig. 60) .... **montivaga** (p. 18)
– Filament well developed (Figs 61, 62, 64–82) 4
4 Uncus large, occasionally constricted at base but otherwise only slightly narrower than tegumen (Figs 61, 62, 66–72). Tegumen with pair of rounded lateral processes as in Fig. 31, or if absent, saccus extends far beyond tegumen anteriorly (Figs 70–72) 5
– Uncus small, and usually considerably narrower than tegumen; tegumen without rounded lateral processes; saccus extends a comparatively short distance beyond tegumen anteriorly (as in Figs 76, 79–82) 13
5 Tegumen without rounded lateral processes; saccus extends far beyond tegumen anteriorly (Figs 70–72) 6
– Tegumen with pair of rounded lateral processes as in Fig. 31; saccus extends at most a short distance beyond tegumen anteriorly (Figs 61, 62, 66–69) 8
6 Filament strongly kinked near apex (Fig. 72) .... **lentiginosella** (p. 32)
– Filament straight (Figs 70, 71) 7
7 Saccus of uniform width; basal half of gnathos increasingly very broad then narrowing sharply to hook-shaped apical half (Figs 46, 71) .... **ocellinella** (p. 29)
– Saccus spatulate, apex approximately twice width of base; gnathos slightly curved, basal half unmodified (Figs 47, 70) .... **fasciata** (p. 31)
8 Filament not extending beyond apex of valva (Figs 61, 68, 69) 9
– Filament extends beyond apex of valva (Figs 62, 66, 67) 11
9 Fore wing with zig-zag pattern of yellowish markings (Figs 11–14). Hind wing with veins *Rs* and M_1 separate, as in Fig. 3 10
– Fore wing without yellowish zig-zag markings. Hind wing with veins *Rs* and M_1 on common stalk, as in Fig. 4 .... **scissella** (p. 20)
10 Sacculus with rounded, moderately broad apex (Fig. 68) .... **flavella** (p. 26)
– Sacculus with pointed, moderately slender apex (Fig. 69) .... **eburnella** (p. 27)
11 Fore wing without zig-zag pattern of yellowish markings. Saccus extremely short and very broad (Figs 35, 36, 62) .... **rhodoptera** (p. 20)
– Fore wing with zig-zag pattern of yellowish markings (Figs 11, 12). Saccus moderately short and broad (Figs 39, 40, 66, 67) 12

12 Filament extends far beyond apex of valva posteriorly, and very far beyond tegumen anteriorly (Fig. 66) .... ***pallidipulchra*** (p. 24)
– Filament extends short distance beyond apex of valva posteriorly, and moderately beyond tegumen anteriorly (Fig. 67) .... ***aflavella*** (p. 25)
13 Sacculus uniformly slender (Figs 73, 80–82) 14
– Sacculus broad, or broader apically than basally, club-shaped or spatulate; otherwise very small, hook-shaped (Figs 57, 59, 74–79) 17
14 Uncus distinctly constricted at base; filament helical in apical half; sacculus gently S-curved (Fig. 73) .... ***constricta*** (p. 33)
– Uncus scarcely constricted at base; filament almost straight or curved dorsoventrally, not helical; sacculus almost straight (Figs 80–82) 15
15 Gnathos almost straight; sacculus does not reach gnathos arms (Fig. 81) .... ***ulicinella*** (p. 42)
– Gnathos distinctly curved; sacculus reaches or extends beyond gnathos arms (Figs 80, 82) 16
16 Filament stout, particularly basally, laterally compressed apically; median projection of hind edge of vinculum high (Fig. 82) .... ***mulinella*** (p. 43)
– Filament very slender; median projection of hind edge of vinculum low (Fig. 80) ***cabezella*** (p. 41)
17 Sacculus stoutly club-shaped (Figs 57, 76, 78, 79) 18
– Sacculus slender and spatulate (Fig. 77) or small and hook-shaped (Figs 74, 75) 20
18 Gnathos extremely short; saccus very slender; filament extends to hind edge of vinculum or just beyond (Figs 49, 76) .... ***monticolella*** (p. 37)
– Gnathos developed normally; saccus comparatively broad; filament does not reach hind edge of vinculum (Figs 51, 52, 78, 79) 19
19 Sacculus scarcely extends beyond median projection of hind edge of vinculum (Fig. 79) ***burdonella*** (p. 40)
– Sacculus extends far beyond median projection of hind edge of vinculum (Fig. 59) ***flavonigrella*** (p. 39)
20 Gnathos very large, without median spine; sacculus long, slender, spatulate (Fig. 77) ***interuptella*** (p. 38)
– Gnathos small, with median, sometimes minute, spine; sacculus small, hook-shaped (Figs 74, 75) .... ***cytisella*** (p. 34)

Females

Note. The females of *scissella, monticolella* and *flavonigrella* are unknown; *constricta* is also omitted since the female genitalia are unknown.

1 Fore wing with large dark spots (Figs 9, 10) 2
– Fore wing with small dark spots or different markings 3
2 Fore wing with large dark spot across fold narrowing gradually from middle towards costa; spot at end of cell comparatively distinct from patch at costa (Fig. 10). Signum present; antrum curved towards anterior, without indented anterior (Fig. 89) .... ***maculatella*** (p. 23)
– Fore wing with large dark spot across fold narrowing sharply from middle towards costa; spot at end of cell merging with patch at costa (Fig. 9). Signum absent or scarcely discernible; antrum straight, with indented anterior (Fig. 88) .... ***denotata*** (p. 22)
3 Antrum same length as apophysis anterior or shorter (Figs 85–87, 90–92, 98) 4
– Antrum extends beyond apophysis anterior (Figs 94, 96–103) 10
4 Antrum extremely short (Figs 85, 98) 5
– Antrum comparatively long (Figs 86, 87, 90–92) 6
5 Signum a narrow ridge with faint surround (Fig. 98). Ductus bursae slightly longer than corpus bursae or of similar length .... ***cytisella*** (p. 34)
– Signum elongate-oval to diamond-shaped with serrated edge (Fig. 85). Ductus bursae approximately four to six times length of corpus bursae .... ***montivaga*** (p. 18)
6 Antrum almost straight, narrowing evenly towards anterior (Figs 92, 93). Fore wing with zig-zag pattern of yellowish markings (Figs 13, 14) 7
– Antrum curved or constricted towards anterior (Figs 86, 90, 91); if not curved and only very slightly constricted (Fig. 87), forewing without zig-zag pattern of yellowish markings 8
7 Antrum with rounded or scarcely indented anterior; abdomen with distinct, longitudinal, median band (Figs 93, 109) .... ***eburnella*** (p. 27)
– Antrum with strongly indented anterior (Fig. 92); abdomen with, at most, very faint band ***flavella*** (p. 26)
8 Abdomen with pair of sclerites and membraneous sac at anterior margin of seventh segment (Fig. 107) .... ***pallidipulchra*** (p. 24)

– Abdomen with unmodified anterior margin of seventh segment 9
9 Signum with approximately three or four large spines projecting from one side, otherwise smooth; seventh abdominal segment comparatively broad (Figs 91, 108) .... ***aflavella*** (p. 25)
– Signum covered with numerous spines of various sizes; seventh abdominal segment narrow (Figs 86, 87, 105, 106) .... ***rhodoptera*** (p. 20)
10 Antrum very long, coiled or strongly curved (Figs 94, 96, 97) 11
– Antrum moderately long, not coiled or strongly curved (Figs 98–103) 13
11 Apophyses anteriores parallel, long; pair of membraneous sacs from sternite, between apophyses anteriores and antrum (Figs 94, 96) 12
– Apophyses anteriores diverging, short; without sacs between apophyses anteriores and antrum (Fig. 97) .... ***lentiginosella*** (p. 32)
12 Apophysis posterior three to four times length of apophysis anterior. Unsclerotized median area of eighth sternite at least as wide as each lateral sclerotized area (Fig. 94) ***ocellinella*** (p. 29)
– Apophysis posterior twice length of apophysis anterior. Unsclerotized median area of eighth sternite narrower than each lateral sclerotized area (Fig. 96) .... ***fasciata*** (p. 31)
13 Apophysis anterior lobe-shaped; eighth sternite strongly sclerotized laterally, contrasting with weak sclerotization of median area (Figs 99, 100) 14
– Apophysis anterior rod-like (Figs 93, 101–103); eighth sternite slightly more sclerotized laterally than medially 15
14 Signum present; median area of eighth sternite without horizontal striations (Fig. 99) ***interuptella*** (p. 38)
– Signum not discernible; median area of sternite with horizontal striations (Fig. 100) ***burdonella*** (p. 40)
15 Antrum straight, narrowing evenly towards anterior; abdomen with median longitudinal band, very distinct in seventh segment (Figs 93, 109) .... ***eburnella*** (p. 27)
– Antrum curved and constricted towards anterior (Figs 101–103); seventh abdominal segment without median longitudinal band 16
16 Base of apophysis anterior with separate rounded lobe towards antrum (Fig. 101) ***cabezella*** (p. 41)
– Base of apophysis anterior without separate lobe (Figs 102, 103) 17
17 Eighth tergite with pair of curved sclerotized lobes overlapping median longitudinal area (Fig. 102) .... ***ulicinella*** (p. 42)
– Eighth tergite without lobes (Fig. 103) .... ***mulinella*** (p. 43)

The *montivaga*-group

Characters as described under *montivaga*.

Mirificarma montivaga (Walsingham) **comb. n.**

(Figs 1, 2, 6, 32, 33, 60, 85, 104)

Gelechia montivaga Walsingham, 1904: 221. LECTOTYPE ♂, ALGERIA (BMNH), here designated [examined].
Gelechia pulverosella Zerny, 1936: 137, pl. 2, fig. 44. LECTOTYPE ♂, MOROCCO (NM), here designated [examined]. **Syn. n.**

♂, 7·5–8·5 mm. ♀, 7·0–7·5 mm. Head cream. Labial palpus cream mottled with brown on outer surface. Thorax, tegula and fore wing (Fig. 6) cream to light brown mottled with brown. Hind wing with veins *Rs* and M_1 separate as in Fig. 3.

GENITALIA ♂ (Figs 32, 33, 60). Uncus large, only slightly narrower than tegumen. Gnathos a moderately large simple hook. Tegumen with pair of rounded lateral processes, sometimes very slight. Actual margin of tegumen slightly less emarginate than sclerotized margin anteriorly; sclerotized margin distinctly X-shaped medially. Sacculus moderately broad. Filament scarcely discernible; filament-supporting sclerites not twisted around each other. Hind edge of vinculum a broad projection, scarcely emarginate medially. Vinculum short, with pair of very short faint sclerites converging from anterior edge. Saccus narrowing slightly towards rounded apex, extending short to moderate distance beyond tegumen anteriorly. Aedeagus same length as tegumen plus uncus or slightly shorter. Aedeagus with bulbous basal half, small to moderate projection near apex, and long ductus ejaculatorius.

GENITALIA ♀ (Figs 85, 104). Posterior margin of seventh abdominal segment with faint dorsal patch of sclerotization and pair of narrow longitudinal stripes ventrally. Very flimsy, broad, rounded invagination of membrane between eighth tergite and papillae anales, directly opposite less flimsy, long, narrow invagination of membrane between sternite and papillae anales. Eighth segment with very weak sclerotization, longitudinally wrinkled, minutely spined anteriorly. Apophysis anterior rod-like, length 0·8–0·9 mm (2); apophysis posterior approximately three times length of apophysis anterior. Antrum slightly indented at anterior and extremely short. Ductus bursae gently coiled, narrow; coiled extent approximately four to six times length of oval or round corpus bursae. Signum very large, elongate oval to diamond shape, with deep longitudinal indentation edged with pair of serrated-edged projecting ridges.

Remarks. The frenulum was examined in the four females and consists of three setae in three of these and two setae in one, on both wings. The X-shaped anterior margin of the tegumen is particularly distinct in *montivaga*, although it occurs to a less degree in *constricta* and is very weak in several other *Mirificarma* species.

M. montivaga is the only species of the genus in which the fore wing has no pattern other than the mottling of the ground colour, although the markings are extremely small in *monticolella, lentiginosella* and a few specimens of *ocellinella*. The ground colour is much darker in *lentiginosella*. *M. montivaga* differs from the rest of the genus in genitalic characters including the scarcely discernible male filament which is merely represented by a slight swelling between the supporting sclerites, the shape of the signum and the extremely long ductus bursae of the female. The long ductus bursae approaches that of *rhodoptera*, but this species has a much longer antrum than *montivaga*.

M. montivaga was described from 3 ♂, 3 ♀ from Algeria: El Kantara, all of which I have examined. I designate the specimen bearing Walsingham's number 96484 as the lectotype. This is referred to as the 'Type ♂' on the specimen label and in the original description in which the date of capture is given as 3.v.1903; however, 1 ♂, 1 ♀, bearing Walsingham's paratype labels, are labelled 9.v.1903.

G. pulverosella was described from 8 ♂, 5 ♀ from Morocco, of which I have examined 3 ♂, 1 ♀. Of these 1 ♂, 1 ♀ bear the labels 'Type ♂' and 'Type ♀' respectively and I designate the male as the lectotype. The 5 ♂, 4 ♀ syntypes which I have not examined are from Tachdirt, middle and end vii (*Zerny*).

Biology. Host-plant unknown. Moths have been found from May to July.

Distribution. Morocco and Algeria.

Material examined (including 6 ♂, 3 ♀ genitalia preparations)

Lectotype ♂ (*montivaga*), **Algeria**: [Constantine province,] El Kantara, 3.v.1903 (*Walsingham*) (genitalia slide no. 7124). Lectotype ♂ (*pulverosella*), **Morocco**: Haut ('Grosser') Atlas, *c.* 17 km SE. of Asni, in highest Iminene Valley, Tachdirt, 2200–2900 m, 11–19.vii. 1933 (*Zerny*) (genitalia slide no. 11223; NM).

Morocco: 1 ♂ (*pulverosella* paralectotype), Haut Atlas, *c.* 70 km SW. of Marrakech, Goundafa area, 3 km above Kasbah Goundafa, at junction of Agoundi Valley in Fis Valley, 'n Zala, above Ijjoukak, 1500–1800 m, 21–29.vi.1933 (*Zerny*) (NM); 1 ♂, Haut Atlas, Oukaïmedene, 2500–2900 m, vii (coll. Burmann, Innsbruck); 1 ♂, 1 ♀ (*pulverosella* paralectotypes), Haut Atlas, Tachdirt, 2200–2900 m, 11–19.vii.1933 (*Zerny*) (NM); 1 ♂, Moyen Atlas, Val d'Ifrane, 1600–1700 m, vi (coll. Burmann, Innsbruck). **Algeria**: 2 ♂, 3 ♀ (*montivaga* paralectotypes), El Kantara, 3, 9.v.1903 (*Walsingham*).

The *maculatella*-group

♂, ♀. Fore wing sometimes with zig-zag pattern of yellowish markings; without median longitudinal stripe. Hind wing with veins Rs and M_1 separate or on common stalk.

Genitalia ♂. Uncus large, only slightly narrower than tegumen. Gnathos a large simple hook. Tegumen with pair of rounded lateral processes. Filament-supporting sclerites usually crossed or spiralled round each other. Hind edge of vinculum a low, broad, sclerotized projection, usually with broad emargination, but without distinctly demarcated median projection. Vinculum without sclerites which extend from saccus and approach hind edge of vinculum. Projection near aedeagus apex usually large, angular and narrowing to point.

Genitalia ♀. Invagination of flimsy membrane between eighth tergite and papillae anales present, immediately opposite invagination of slightly less flimsy membrane between sternite and papillae anales. Eighth segment weakly sclerotized. Apophysis anterior rod-like, long. Signum, if well developed, with large spines; small spines sometimes also present.

REMARKS. The filament-supporting sclerites of the male genitalia are more strongly spiralled round each other in the species in which they are long, particularly *maculatella* and *rhodoptera*. Although the vinculum does not have sclerites extending from the saccus and approaching the hind edge of the vinculum, in a few species the anterior margin of the vinculum is continued towards the median as faint, narrow, short sclerites on either side of the saccus. This is seen in *rhodoptera* and *pallidipulchra* and, even more faintly, in one specimen of *aflavella*; in *scissella* the anterior margin of the vinculum is sometimes continuous across the saccus posterior as a narrow sclerite. The sclerotization of the eighth segment is uniformly weak or limited to smaller areas than in most of the *interuptella*-group, but is always greater than in *montivaga*.

BIOLOGY. Host-plants: Trifolieae (other than *Ononis*); Loteae; Coronilleae; Galegeae; Vicieae.

Mirificarma scissella (Chrétien) **comb. n.**

(Figs 1, 2, 7, 34, 61)

Gelechia scissella Chrétien, 1915: 319. LECTOTYPE ♂, ALGERIA (MNHN), here designated [examined].

♂, 7·0–7·5 mm. Head whitish cream. Labial palpus cream, mottled with brown at base. Thorax and tegula cream mottled with brown. Fore wing (Fig. 7) cream to pale brown, mottled with brown; slightly darker at extreme base and at costa in four-fifths. Dark brown spot across fold at one-third with trace at dorsal margin. Small dark brown spot at end of cell. Hind wing with veins *Rs* and M_1 on common stalk as in Fig. 4.

GENITALIA ♂ (Figs 34, 61). Actual margin of tegumen less emarginate than sclerotized margin anteriorly. Sacculus broad at base, slightly wrinkled at narrower apex. Filament very slightly curved, slender, not reaching apex of valva posteriorly, extending short to moderate distance beyond tegumen anteriorly. Filament-supporting sclerites not or scarcely twisted. Hind edge of vinculum with shallow U- or V-shaped emargination of sclerotization. Saccus usually moderately broad, scarcely narrower towards rounded apex, extending short distance beyond tegumen anteriorly. Aedeagus approximately same length as tegumen plus uncus, slender; apical projection moderately large, not distinctly pointed.

GENITALIA ♀. Unknown.

REMARKS. This species bears a superficial resemblance to *rhodoptera, constricta* and *cabezella*, although the head is paler and the spot in the fold of the fore wing scarcely extends to the dorsal margin; however, the only specimens known of *scissella* are in poor condition externally. It differs from *rhodoptera* in the hind wing venation, and the shorter filament and longer saccus of the male genitalia. It differs from *constricta* and *cabezella* in some genitalic characters, including the presence of a pair of rounded processes on the male tegumen, since these last two species are in the *interuptella*-group.

M. scissella was described from an unspecified number of specimens of which I designate as lectotype the single type-specimen examined. The coating of debris on this specimen renders it almost unrecognizable externally. One of the rounded processes of the tegumen is absent in the lectotype.

BIOLOGY. Host-plant unknown. Moths have been found in April and May.

DISTRIBUTION. Algeria.

MATERIAL EXAMINED (including 2 ♂ genitalia preparations)

Lectotype ♂, **Algeria**: [Constantine province,] Biskra, 7.v.1907 (genitalia slide no. 43, LMP; MNHN).
Algeria: 1 ♂, M'zab ('Uzab') country, Oued Nsa ('Nza'), iv; 1 ♂, Hamman-es-Salahine, iv.

Mirificarma rhodoptera (Mann)

(Figs 1, 2, 8, 35, 36, 62, 63, 86, 87, 105, 106)

Gelechia rhodoptera Mann, 1866: 353, pl. 1 (B), fig. 10. Holotype ♂, RUMANIA ('Turkey') (NM) [examined].

♂, 5·0–7·5 mm, ♀, 5·5–7·0 mm. (Typical form. ♂, 6·5–7·5. ♀, 6·0–7·0. Small form. ♂, 5·0–6·5 mm. ♀, 5·5–6·0 mm.) Both forms. Head mid brown. Labial palpus mottled cream and brown; darker on outer surface. Thorax and tegula mottled mid brown. Fore wing (Fig. 8) mottled light brown, very faintly pink-tinged, and dark brown; darker at base and in apical third; ochreous tinge near base. Small cream patch at costa at two-thirds extending diffusely to dorsal margin. Narrow, transverse dark brown spot across fold at one-third extending to dorsal margin. Smaller dark brown spot at end of cell, constricted medially, occasionally bisected. Both spots with ochreous cream surround. Very small diffuse dark brown spot in fold at one-fifth. Hind wing with veins *Rs* and M_1 separate as in Fig. 3.

GENITALIA ♂ (Figs 35, 36, 62, 63). Actual margin of tegumen less emarginate than sclerotized margin anteriorly. Sacculus short, moderately broad, wrinkled. Filament slightly helical, slender, extending posteriorly moderately beyond apex of valva, and very far beyond tegumen anteriorly. Hind edge of vinculum with broad, shallow U- or V-shaped emargination of sclerotization. Saccus very broad, usually with very shallow emargination at apex; extremely short, never reaching anterior margin of tegumen. Aedeagus approximately three-quarters length of tegumen plus uncus, basal half very slightly swollen; apical projection small.

GENITALIA ♀ (Figs 86, 87, 105, 106). Posterior margin of seventh abdominal segment with area of weak sclerotization merging with progressively faint median longitudinal band. Seventh abdominal segment comparatively narrow, anterior margin unmodified. Invagination of membrane between eighth sternite and papillae anales indistinct, extremely long and narrow. Eighth sternite with lateral pair of weakly sclerotized strips. Tergite and rest of sternite very weakly sclerotized, with minute spines mainly on sternite extending into posterior of antrum. Apophysis anterior length in typical form 1·2–1·3 mm (3); small form 0·6–0·7 mm (3); apophysis posterior twice length of apophysis anterior in each form. Antrum scarcely curved; anterior sometimes slightly indented, particularly in small form. Antrum of typical form very broad posteriorly, constricted strongly to narrow anterior half; shorter than apophysis anterior. Antrum of small form moderately broad posteriorly, constricted comparatively slightly for short distance at anterior; almost as long as apophysis anterior. Ductus bursae approximately two to four times length of oval corpus bursae. Signum covered with large and small spines; signum of typical form large, elongate kidney-shape, strongly curved inwards; signum of small form comparatively small, oval to broad kidney-shape, scarcely curved inwards.

REMARKS. One specimen has veins *Rs* and M_1 on a very short common stalk in one hind wing. The frenulum, examined in seven females, consists of three setae in three of these, two setae in one of these, and in three it consists of three setae on one wing and two on the other.

The specimens examined from Lakonia in Greece are smaller, on average, than the typical form, particularly in the genitalia. The small form is typical externally except that the fore wing markings tend to be relatively slightly smaller. Apart from the size, the female genitalia show some consistent differences in structure from the typical form. The eighth sternite has slightly longer, narrower sclerotized strips than in the typical form, the narrow anterior part of the antrum is considerably shorter and the signum differs in shape. The saccus is variable in length but tends to be more pronounced in the small form. It is possible that the Lakonia specimens may prove to be a distinct species; however, the differences are comparatively slight for the genus. There is insufficient material to determine whether the Lakonia population represents a distinct subspecies of *rhodoptera*. The few specimens I have seen from other Greek localities are of the typical form. A difference in the genitalia of one sex within a species is also discussed for *cytisella* (see p. 34).

M. rhodoptera bears a superficial resemblance to *scissella, constricta* and *cabezella*. It differs from all these in the hind wing venation, and the very long filament and very short saccus of the male genitalia, and in addition differs from *constricta* and *cabezella* in many genitalic characters since these two species are in the *interuptella*-group.

BIOLOGY. Host-plant unknown. Moths of the typical form have been found in June and July, those of the small form in May and June.

DISTRIBUTION. Rumania, Greece, Turkey, Lebanon.

MATERIAL EXAMINED

Typical form (including 4 ♂, 4 ♀ genitalia preparations)

Holotype ♂, **Rumania** ('Turkey'): Dobrogea ('Dobrudscha'), far outside Tulcea ('Tultscha'), middle vi.1865 (*Mann*) (genitalia slide no. 11225; NM).

Greece: 1 ♀, Parnass[ós] Mts, vii (MNHU); 1 ♂, 3 ♀, Pelop[ónnisos], near Kalav[rita], Zakhlorou, vi

(Coll. Klimesch, Linz). **Turkey**: 1 ♀, Maraş ('Marasch'), vii (MNHU). **Lebanon**: 2 ♂, N., Bcharre ('Becharré'), 1400 m, vi, vii (NM).

Small form (including 3 ♂, 4 ♀ genitalia preparations)

Greece: 1 ♀, Lakonía, 7 km SW. of Monemvasía, v; 4 ♂, 5 ♀, Lakonía, 5 km S. of Monemvasía, v, vi; 1 ♂, Lakonía, Mt Taygetos, 1000 m, vi (all ZM).

Mirificarma denotata sp. n.

(Figs 1, 2, 9, 37, 64, 88)

♂, 7·5–8·5 mm. ♀, 7·0–8·0 mm. Head light or occasionally mid brown. Labial palpus first and third segments dark brown and cream; second segment predominantly cream. Thorax and tegula brown; tegula base usually darker. Fore wing (Fig. 9) mottled brown and light pink-grey, ochreous tinge near base; apical quarter to third predominantly dark brown, edged with diffuse, basal, transverse pink and cream streak pronounced at costa; moderately dark brown patches slightly basal to streak at costa and dorsal margin, and at base. Large transverse dark brown spot across fold at one-third extending to dorsal margin, narrowing sharply from middle towards costa; dark brown spot at end of cell merging with patch at costa, comparatively distinct from patch at dorsal margin. Both spots with narrow yellow-ochre surround. Hind wing with veins *Rs* and M_1 on common stalk as in Fig. 4.

GENITALIA ♂ (Figs 37, 64). Actual margin of tegumen less emarginate than sclerotized margin anteriorly. Sacculus short, moderately broad, flattened, slightly wrinkled at apex. Filament slightly helical, slender, extending posteriorly short distance beyond valva, and well beyond tegumen anteriorly. Hind edge of vinculum with moderately shallow U- or V-shaped emargination of sclerotization. Saccus broad basally, narrow apically, extending slightly beyond tegumen anteriorly. Aedeagus approximately same length as tegumen plus uncus. Aedeagus portion apical to hook small; apical hook moderately large.

GENITALIA ♀ (Fig. 88). Posterior margin of seventh abdominal segment with area of weak sclerotization mainly on tergite. Invagination of membrane between eighth sternite and papillae anales indistinct, long narrow tube without sac. Flimsy membrane between eighth tergite and papillae anales invaginated to broad rounded pouch. Eighth sternite with lateral pair of narrow, longitudinal sclerotized strips. Tergite and rest of sternite very weakly sclerotized, with faint longitudinal wrinkles. Apophysis anterior length 0·9–1·1 mm (2); apophysis posterior approximately three times length of apophysis anterior. Antrum almost straight, narrowing considerably towards indented anterior; approximately same length as apophysis anterior. Antrum with minute spines mainly in posterior half. Ductus bursae approximately twice length of oval corpus bursae. Signum absent or scarcely discernible.

REMARKS. One specimen has the veins *Rs* and M_1 just separate in one hind wing. The frenulum was examined in one female and consists of three setae. During the preparation of the male genitalia, a tiny narrow projection was seen near the apex of the filament of one specimen, similar to that visible in *maculatella* and *ocellinella*, although not obviously tubular as in the latter.

M. denotata is very similar to *maculatella* in the fore wing pattern, but differs very slightly in the form of the two large fore wing spots. The hind wing venation of *denotata* usually differs from that of *maculatella*. The male genitalia are very similar to those of *maculatella* although the shape of the extreme apex of the aedeagus differs; the female genitalia differ from those of *maculatella* in characters including the shape of the antrum and the absence of a signum.

BIOLOGY. Host-plant: Galegeae: *Astragalus lusitanicus* Lamarck (type-specimens bred by Walsingham). The moths emerged in late April and May.

DISTRIBUTION. Morocco.

MATERIAL EXAMINED (including 3 ♂, 2 ♀ genitalia preparations)

Holotype ♂, **Morocco**: [SE. of Tanger], El Fendek ('Fondak'), larva 28.iv.1902, on *Astragalus lusitanicus*, moth emerged 27.v.1902 (*Walsingham*) (genitalia slide no. 22027).

Paratypes. 4 ♂, 2 ♀, same data as holotype, moths emerged 22–30.v.1902.

Mirificarma maculatella (Hübner)

(Figs 1–3, 10, 38, 65, 89)

Tinea maculatella Hübner, 1796: 60, pl. 24, fig. 162 [legends to figs 161 and 162 are transposed]. LECTOTYPE ♂, EUROPE (NM), here designated [examined].
Gelechia maculatella (Hübner) Stainton, 1865: 228, pl. 7, fig. 3.
[*Gelechia vicinella* Douglas; Bruand d'Uzelle, 1858: 481; Disqué, 1908: 65. Misidentifications.]

♂, 7·0–9·5 mm. ♀, 7·5–9·0 mm. Head mottled mid brown. Labial palpus mottled cream or light brown, and dark brown. Thorax and tegula mottled mid brown. Fore wing (Fig. 10) mottled brown and light pink-grey; ochreous tinge near base; apical quarter to third predominantly dark brown, edged with diffuse, basal, transverse pink and cream streak pronounced at costa; moderately dark brown patches slightly basal to streak at costa and dorsal margin, and at base. Large transverse dark brown spot across fold at one-third extending to dorsal margin, narrowing gradually from middle towards costa; dark brown spot at end of cell comparatively distinct from patch at costa, usually merging with patch at dorsal margin. Both spots with narrow ochreous surround. Hind wing with veins *Rs* and M_1 separate (Fig. 3).

GENITALIA ♂ (Figs 38, 65). Actual margin of tegumen less emarginate than sclerotized margin anteriorly. Sacculus short, broad, slightly flattened, strongly wrinkled at apex and inner edge. Filament slightly helical, slender, extending posteriorly well beyond apex of valva, and anteriorly, beyond tegumen. Hind edge of vinculum with broad, moderately shallow U- or V-shaped emargination of sclerotization. Saccus broad basally, narrow apically, extending a short distance beyond tegumen anteriorly. Aedeagus slightly longer than tegumen plus uncus. Aedeagus portion apical to hook large; apical hook large.

GENITALIA ♀ (Fig. 89). Posterior margin of seventh abdominal segment with small area of weak sclerotization mainly on tergite. Invagination of membrane between eighth sternite and papillae anales very long narrow tube ending in pronounced, large oval sac. Eighth sternite with lateral pair of broad, moderately short sclerotized strips. Tergite and rest of sternite very weakly sclerotized; tergite with faint longitudinal wrinkles. Apophysis anterior length 0·9–1·0 mm (6); apophysis posterior approximately twice length of apophysis anterior. Membraneous area between antrum and each apophysis anterior produced into slight lobe, covered in minute spines. Antrum curved and narrower towards anterior; anterior not indented; approximately 1·5 times to less than twice length of apophysis anterior. Antrum with minute spines mainly in posterior half and extending into median area of sternite. Ductus bursae shorter than or of similar length to round corpus bursae. Signum moderately large, round or oval; with spines, large around edge.

REMARKS. In approximately 7 per cent of the specimens examined the veins *Rs* and M_1 are on a common stalk in one or both hind wings. The frenulum of five out of six females examined consists of three setae; in the remaining female it consists of three setae on one wing and two on the other. During the preparation of the male genitalia, a tiny narrow projection was seen near the apex of the filament, similar to those in *denotata* and *ocellinella*, although not obviously tubular as in the latter.

The fore wing pattern of *maculatella* clearly distinguishes it from all other species except *denotata* to which it is very similar. For differences from *denotata* see p. 22.

M. maculatella was described from an unspecified number of specimens. In the NM there is one specimen from Mazzola's collection, here designated as lectotype, already labelled 'lectotype' by Sattler.

BIOLOGY. Host-plants: Coronilleae: *Coronilla varia* L. (moths bred by Mühlig, W. Germany; Stainton, 1865: 228). *C. emerus* L. (Bruand d'Uzelle, 1858: 482, as *Gelechia vicinella* Douglas; also subsequent authors).

The larva occurs in May and June feeding in two opposite leaflets spun together. It pupates in a slight cocoon on the ground (Stainton, 1865: 228). Stainton records only one generation per year. Pröse (1957: 111) records the larva in July. Moths have been collected from June to August.

DISTRIBUTION. France; Germany; Austria; Czechoslovakia; Yugoslavia; Turkey; Syria.

Additional records. Switzerland (Müller-Rutz, 1914: 489); Italy (Hartig, 1964: 27); Poland (Schille, 1931: 179); Hungary (Gozmány, 1958: 227); Albania (Rebel, 1931: 146); U.S.S.R.: Ukraine (Piskunov, 1981: 674).

MATERIAL EXAMINED (including 8 ♂, 6 ♀ genitalia preparations)

Lectotype ♂, **Europe** (*Mazzola*) (genitalia slide no. 11221; NM).

France: 1 ♂, 1 ♀, Paris; 1 ♂, Basses-Alpes, viii. **Germany**: 1 ♂, —; 1 ♂, 1 ♀, 'N. Germany'. **Germany (West)**: 1 ♂, 4 ♀, Hessen, vii; 1 ♂, 2 ♀, Bayern. **Germany (East)**: 8 ♂, 11 ♀, Gera. **Austria**: 1 ♂, Nieder-Österreich, vii. **Czechoslovakia**: 1 ♂, Bohemia (NM). **Yugoslavia**: 1 ♂, Croatia (NM); 1 ♀, Dalmatia (NM); vi. **Turkey**: 1 ♂, Konya, vii (NM); 1 ♂, Amasya (MNHU). **Syria**: 1 ♀, NW., vi (NM). No locality data: 15 ex.

Mirificarma pallidipulchra (Walsingham) **comb. n.**

(Figs 1, 2, 11, 39, 66, 90, 107)

Rhinosia pallidipulchra Walsingham, 1904: 269. LECTOTYPE ♂, ALGERIA (BMNH), here designated [examined].

Rhinosia striolella Turati, 1924: 166, pl. 6, fig. 11. LECTOTYPE ♂, LIBYA (BMNH), here designated [examined]. **Syn. n.**

♂, 6·5–8·5 mm. ♀, 6·5–8·0 mm. Head cream to moderately light brown. Labial palpus cream frequently tinged with brown ventrally. Thorax and tegula as head. Fore wing (Fig. 11) with alternating transverse indistinct zig-zag patches of cream and ochre or occasionally deep yellowish brown; darker markings usually narrow. Several very narrow yellowish or brown striations radiating from wing base towards apex. Fore wing markings mostly weakly or moderately, occasionally strongly, contrasting. Hind wing with veins *Rs* and M_1, separate as in Fig. 3.

GENITALIA ♂ (Figs 39, 66). Actual margin of tegumen usually coincides with sclerotized margin anteriorly. Sacculus moderately slender in apical half; apex wrinkled. Filament slightly helical, slender, extending posteriorly well beyond valva, and very far beyond tegumen anteriorly. Hind edge of vinculum with V-shaped emargination of sclerotization. Saccus moderately broad, apex truncate or very slightly emarginate; short, not quite reaching anterior of tegumen. Aedeagus approximately same length as tegumen plus uncus; basal half very slightly swollen, with moderately large apical hook.

GENITALIA ♀ (Figs 90, 107). Abdomen with patchy, broad, median, longitudinal band constricted at anterior margin of sixth sternite. Seventh abdominal sternite with pair of sclerites and membraneous sac at anterior margin. Invagination of membrane between eighth sternite and papillae anales long, narrow, funnel-shaped. Eighth sternite with lateral pair of weakly sclerotized, broad strips. Tergite and rest of sternite very weakly sclerotized. Apophysis anterior length 0·9–1·0 mm (6); apophysis posterior approximately three times length of apophysis anterior. Antrum curved or constricted towards anterior, slightly shorter than or of similar length to apophysis anterior. Antrum with a few minute spines around posterior; anterior sometimes very slightly indented. Ductus bursae shorter than oval or pear-shaped corpus bursae. Signum large, spinose, particularly around edge, strongly curved inwards.

REMARKS. In approximately 7 per cent of the specimens examined the veins *Rs* and M_1 are on a short common stalk in one hind wing. The frenulum was examined in five females and consists of three setae. In the male genitalia the sclerotized anterior margin of the vinculum does not coincide with the actual margin of the vinculum, although both are often indistinct. This occurs in a few other *Mirificarma* species but in these one of the margins is much more distinct than the other, whereas in *pallidipulchra* both margins appear equally faint. The constriction of the female abdominal band of this species and *aflavella* is seen to a much less degree in some other species (*montivaga, rhodoptera, flavella, ocellinella* and *fasciata*).

M. pallidipulchra closely resembles *eburnella, aflavella* and *flavella* in the fore wing pattern, although its darker markings tend to be narrower, but it is distinguished from these species by the very long filament of the male genitalia and the pair of sclerites with the membraneous sac of the female abdomen. This last character is unique within the genus.

M. pallidipulchra was described from 23 specimens from Algeria: Hamman-es-Salahine, 18.iv, and El Kantara. I have examined 9 ♂, 9 ♀ from El Kantara and designate as lectotype the specimen bearing Walsingham's number 96479. This is referred to as the 'Type ♂' on the specimen label and in the original description. 1 ♂, 1 ♀ of the remaining syntypes which I have not examined are in the NM.

R. striolella was described from 4 ♂ from Libya, all of which I have examined. The specimen I designate as lectotype, which bears Turati's 'Typus' label, was already labelled 'lectotype' by Sattler.

BIOLOGY. Host-plant unknown. According to Walsingham (1904: 270) the moths are always found among stems and root-crowns of *Teucrium* (*polium* L. ?) (Labiatae), but it seems very unlikely that this is the host-plant. Moths have been found in March to May and July.

DISTRIBUTION. Algeria, Tunisia, Libya.

A record of this species from Egypt (Rebel, 1914: 268) is a misidentification of *eburnella*.

MATERIAL EXAMINED (including 9 ♂, 6 ♀ genitalia preparations)

Lectotype ♂ (*pallidipulchra*), **Algeria**: [Constantine province,] El Kantara, 5.v.1903 (*Walsingham*) (genitalia slide no. 22491). Lectotype ♂ (*striolella*), **Libya**: Cyrenaica, Benghāzī, 20.iii.1922 (*Krüger*) (genitalia slide no. 22490).

Algeria: 1 ♀, Oran, Aflou, vii; 1 ♂, 1 ♀, Hassi Bahbah, v (NM); 8 ♂, 9 ♀ (*pallidipulchra* paralectotypes), El Kantara, 24.iv, 4, 5, 11.v.1903 (*Walsingham*); 1 ♀, Constantine, Khenchela, v ? **Tunisia**: 1 ♀, Tozeur, iv (MNHN); 1 ♀, Hammamet, v (NM). **Libya**: 1 ♂, 4 ♀, Tripolitania, Gharyān ('Garian'), 700 m, iii, iv; 5 ♀, Tripolitania, Tarhūnah, 200 m, iv; 1 ♂, 1 ♀, Tripolitania, Banī Walīd ('Beni Ulid'), 300 m, iv; 5 ♂, 1 ♀, Tripolitania, Al Khums ('Homs'), 10 m, iv; 2 ♂ (*striolella* paralectotypes), Cyrenaica, Benghāzī, 18, 20.iii.1922 (*Krüger*); 1 ♂ (*striolella* paralectotype), Cyrenaica, Benghāzī, 'Merg', 9.iv (*Krüger*).

Mirificarma aflavella (Amsel) **stat. n.**

(Figs 1, 2, 12, 40, 67, 91, 108)

Rhinosia flavella aflavella Amsel, 1935: 275. LECTOTYPE ♂, ISRAEL (LN), here designated [examined].

♂, 7·5–9·5 mm. ♀, 7·5–9·5 mm. Head moderately light golden-brown. Labial palpus mostly cream dorsally, golden-brown ventrally. Thorax and tegula as head. Fore wing (Fig. 12) with alternating transverse zig-zag patches of light golden-brown and mid brown, weakly contrasting. Hind wing with veins *Rs* and M_1 usually on common stalk as in Fig. 4.

GENITALIA ♂ (Figs 40, 67). Actual margin of tegumen slightly less emarginate than sclerotized margin anteriorly. Sacculus moderately broad, apex wrinkled. Filament gently curved; moderately stout in basal half, tapering apically; extending posteriorly short distance beyond valva, and moderately far beyond tegumen anteriorly. Hind edge of vinculum with V-shaped emargination of sclerotization. Saccus moderately broad, narrowing slightly towards rounded apex; short, approximately reaching anterior of tegumen. Aedeagus almost as long as tegumen plus uncus; with moderately large apical hook.

GENITALIA ♀ (Figs 91, 108). Abdomen with diffuse, broad, median, longitudinal band, slightly more distinct at posterior margin of seventh segment, strongly constricted at anterior margin of sixth sternite. Seventh abdominal segment comparatively broad, anterior margin unmodified. Invagination of membrane between eighth sternite and papillae anales long, narrow, funnel-shaped. Eighth sternite with lateral pair of broad sclerotized strips. Tergite and rest of sternite very weakly sclerotized. Apophysis anterior length 0·7–0·9 mm (5); apophysis posterior three times length of apophysis anterior. Antrum curved or constricted anteriorly, of similar length to apophysis anterior; with minute spines posteriorly, extending into median area of sternite. Antrum anterior sometimes very slightly indented. Ductus bursae one-quarter to slightly more than one-third length of elongate pear-shaped corpus bursae. Signum with approximately three or four large spines arising from sclerotized ridge on one side, otherwise smooth.

REMARKS. In approximately 25 per cent of the specimens examined the veins *Rs* and M_1 are separate in one or both hind wings. The frenulum consists of three setae (five females examined). In the female genitalia the ductus bursae merges gradually with the corpus bursae and is distinguished only by its paler appearance in stained preparations.

This species resembles *pallidipulchra, flavella* and *eburnella* in fore wing pattern. It is particularly close to *flavella* in this respect although the fore wing pattern is slightly less contrasted. *M. aflavella* differs from these three species in the male genitalia, in which the filament extends a short distance beyond the apex of the valva, and in the form of the signum of the female genitalia.

M. aflavella was originally described as a subspecies of *flavella*, with which it is allopatric. However, I consider that the genitalic differences between them are sufficient to separate them as distinct species; moreover, *aflavella* appears to have even more features in common with *pallidipulchra* than with *flavella*.

M. aflavella was described from a series collected by Amsel in Palestine, 1930: Tabgha, 12.iii; Jordan, Salt, 7.iv, and Waldheim (*c.* 15 km E. of Haifa), 9.v (Amsel, 1935: 265). I have examined 8 ♂, 4 ♀, from Tabgha, all of which probably belong to the type-series although some lack Amsel's type-labels and are dated 15.iii instead of 12.iii. The specimen I designate as lectotype, which bears Amsel's label 'Typus', was already labelled 'lectotype' by Sattler.

BIOLOGY. Host-plant unknown. Moths have been found from March to May.

DISTRIBUTION. Greece (Ródhos), Turkey, Israel (including Jordan west bank territories).

MATERIAL EXAMINED (including 4 ♂, 5 ♀ genitalia preparations)

Lectotype ♂, **Israel**: ('Palästina'), 10 km N. of Tiberias, En Sheva ('Tabgha'), 12.iii.1930 (*Amsel*) (genitalia slide no. 17, LMP.; LN).

Greece: 1 ♀, Ródhos ('Rhodes'), Miramare [Hotel], iv. **Turkey**: 1 ♀, Gâvur Dağlari ('Amanus'), 'Schechle', v (NM); 1 ♂, Gâvur Dağlari, 'Tarib', v (NM); 3 ♂, 1 ♀, Haleb, Shar Deresy ('Shar Devesy'). **Israel**: 1 ♂, 3 ♀, ('Palestine'), Haifa, iii–v; 3 ♂, 3 ♀ (paralectotypes), ('Palästina'), Tiberias, En Sheva ('Tabgha'), iii.1930 (*Amsel*) (BMNH and LN); 4 ♂, 1 ♀ (paralectotypes ?), Tiberias (including 3 ♂, 1 ♀, 'See Genezareth'), En Sheva ('Tabgha'), iii, 15.iii.1930 (*Amsel*) (NM); 2 ♀, Palestine, plains of Jordan.

Mirificarma flavella (Duponchel)

(Figs 1, 2, 13, 41, 42, 68, 92)

Acompsia flavella Duponchel, [1844]: 512, pl. 89, fig. 7. Type(s), FRANCE: Bondy Forest, end of vi (*Bégrand*) [not traced].

Gelechia segetella Zeller, 1847: 847. LECTOTYPE ♂, SICILY (BMNH), here designated [examined]. [Synonymized by Wocke, 1861: 115.]

♂, 7·0–9·0 mm. ♀, 7·5–9·0 mm. Head yellowish. Labial palpus cream to yellowish, sometimes tinged with brown ventrally. Thorax yellowish, occasionally with faint brown median longitudinal stripe; tegula yellow-ochre to golden-brown. Fore wing (Fig. 13) with alternating transverse zig-zag patches of yellowish colour and deep yellow-tinged brown; moderately strongly contrasting. Hind wing with veins *Rs* and M_1 separate as in Fig. 3.

GENITALIA ♂ (Figs 41, 42, 68). Actual margin of tegumen variable but usually slightly less emarginate than sclerotized margin anteriorly. Sacculus with rounded, moderately broad apex. Filament moderately stout at base, tapering and slightly curved towards apex; almost reaching apex of valva posteriorly, extending slightly or scarcely beyond tegumen anteriorly. Hind edge of vinculum with median U- or V-shaped emargination of sclerotization. Saccus broad to very broad, sometimes narrower at rounded apex, reaching or extending slightly beyond tegumen anteriorly. Aedeagus same length as tegumen plus uncus or slightly longer; with moderately large apical hook.

GENITALIA ♀ (Fig. 92). Abdomen with at most faint median, longitudinal band. Eighth sternite and tergite very weakly sclerotized; sternite with faint lateral areas of sclerotization. Apophysis anterior length 0·8–1·0 mm (8); apophysis posterior approximately three times length of apophysis anterior. Antrum almost straight, tapering, usually slightly, towards strongly indented anterior; slightly shorter than apophysis anterior; without minute spines. Ductus bursae slightly shorter to longer than oval or round corpus bursae. Signum small to medium-sized; spinose, particularly around edge.

REMARKS. The fore wing pattern varies from predominantly yellowish to predominantly brown. The frenulum consists of three setae (five females examined). The sacculus of the male genitalia tends to be longer than that in *eburnella* or *aflavella*. The saccus is usually relatively broader than in *eburnella* although it is variable in both species.

M. flavella resembles *eburnella, aflavella* and *pallidipulchra* in the fore wing pattern, particularly *aflavella*, although the fore wing pattern of *flavella* is usually more contrasted than in *aflavella*. The male genitalia of *flavella* differ from those of *eburnella* by the rounded apex of the sacculus, and from the other two species by the relatively short filament. The female genitalia differ in having a straight antrum together with an indented apex.

M. flavella was described from an unspecified number of specimens from France: Bondy

Forest (near Paris). The type-specimens have not been traced and are not in the MNHN (Viette, pers. comm.).

G. segetella was described from an unspecified number of specimens from Sicily: Siracusa. I have examined 1 ♂, 1 ♀ syntypes and designate as lectotype the male already labelled 'lectotype' by Sattler.

BIOLOGY. Host-plants: Trifolieae: *Trifolium pratense* L. (moth bred by Frey, France). '*T. minus* Rehl. = *procumbens* G.G.' (the identity of this *Trifolium* species is not clear since *minus* is currently a synonym of *T. dubium* Sibthorp and *procumbens* is a synonym of *T. campestre* Schreber). Loteae: *Lotus corniculatus* L.

These host-plants are referred to by Lhomme ([1948–1949]: 653), who states that the larva has been found in May and June. Moths have been collected from April to July.

G. segetella was described from moths collected on the edges of wheatfields and on chrysanthemum-like flowers (Compositae); however, there is no reason to suppose that the latter could be its host-plant.

DISTRIBUTION. France, Corsica, Italy, Sardinia, Sicily, Greece, Crete, Cyprus, Algeria, Tunisia.

Additional records. Spain (Agenjo, 1968: [4]); Belgium (Lhomme, [1948–1949]: 652); Greece: Attiki (Staudinger, 1871: 255).

The following records should probably be referred to *aflavella*. Israel: Jerusalem (Caradja, 1920: 112); 'Palestine'; Turkey ('Kleinasien') (Wocke, 1871: 300); Turkey ('Asia Minor'); Syria (Rebel, 1901: 158; Meess (*in* Spuler, 1910: 344); Meyrick, 1925: 142); Turkey ('Asia Minor') (Rebel, 1903: 332).

A record of the species from Bulgaria: Rilo (Rebel, 1903: 332) is based on a misidentification of *Orophia ferrugella* ([Denis & Schiffermüller]) (Oecophoridae). A record of *flavella* from Yugoslavia: Dalmatia (Rebel, 1903: 332) may also be a misidentification of *O. ferrugella*.

MATERIAL EXAMINED (including 5 ♂, 8 ♀ genitalia preparations)

Lectotype ♂ (*segetella*), **Sicily**: Siracusa, v. (*Zeller*) (genitalia slide no. 7135).

France: 1 ♀, —; 1 ♂, Ille et Vilaine; 1 ♂, Mayenne (MNHN); 1 ♂, Calvados (MNHN); 1 ♀, Sarthe (MNHN); 1 ♂, Essonne (MNHN); 2 ♂, 5 ♀, Paris; 4 ♂, 1 ♀, Alpes-Maritimes; vi, vii. **Corsica**: 7 ♂, vi. **Italy**: 3 ♂, 3 ♀, Toscana, vi, vii. Sardinia: 1 ♀, vi ? (NM). **Sicily**: 1 ♀ (*segetella* paralectotype), Siracusa, v. **Crete**: 2 ♀, v, vi (NM). **Cyprus**: 7 ♂, 8 ♀, iv, v. **Algeria**: 2 ♂, Algiers province (MNHN); 2 ♀, Constantine province, vi. **Tunisia**: 1 ♀. No locality data: 23 ex.

Mirificarma eburnella ([Denis & Schiffermüller]) **comb. n.**

(Figs 1, 2, 14, 43, 69, 93, 109)

Tinea eburnella [Denis & Schiffermüller], 1775: 140. Syntypes, AUSTRIA: Wien area (lost). NEOTYPE ♂, AUSTRIA (NM), here designated [examined].

Tinea formosella Hübner, 1796: 62, pl. 23, fig. 160. Syntypes, SWITZERLAND: Genf ('Genève') [not traced]. [Junior primary homonym of *Tinea formosella* [Denis & Schiffermüller], 1775: 140 (Oecophoridae).]

Carcina flammella Hübner, [1825]: 410. [Objective replacement name for *Tinea formosella* Hübner.] [Synonymized by Zeller, 1847: 848.]

Gelechia rufeoformosella Bruand d'Uzelle, 1859: 652. [Objective replacement name for *Tinea formosella* Hübner.]

[*Rhinosia palidipulchra* Walsingham; Rebel, 1914: 268. Incorrect subsequent spelling of *pallidipulchra* Walsingham. Misidentification.]

Mirificarma formosella (Hübner) Căpuşe, 1964: 17, figs 7, 8.

♂, 5·0–7·5 mm. ♀, 5·5–7·5 mm. Head cream. Labial palpus cream, frequently tinged with brown ventrally. Thorax cream with faint, narrow, median, longitudinal, yellow-ochre stripe; tegula yellow-ochre. Fore wing (Fig. 14) with alternating transverse zig-zag patches of cream and yellowish to ochre, strongly contrasting. A few very narrow ochre striations radiating from wing base towards apex. Hind wing with veins *Rs* and M_1 separate as in Fig. 3.

GENITALIA ♂ (Figs 43, 69). Actual margin of tegumen considerably less emarginate than sclerotized margin anteriorly. Sacculus with pointed, moderately slender apex. Filament moderately slender, almost straight, almost reaching apex of valva posteriorly, extending short to moderate distance beyond tegumen anteriorly. Hind edge of vinculum with U- or V-shaped emargination of sclerotization. Saccus broad, slightly narrower at rounded apex, extending short distance beyond tegumen anteriorly. Aedeagus same length as tegumen plus uncus or slightly longer; apical hook usually moderately large.

GENITALIA ♀ (Figs 93, 109). Abdomen with distinct broad, median, longitudinal band, most prominent in seventh segment. Eighth sternite and tergite very weakly sclerotized; sternite with faint lateral areas of sclerotization. Apophysis anterior length 0·6–0·9 mm (10); apophysis posterior three to four times length of apophysis anterior. Antrum almost straight, tapering, usually slightly, towards rounded or scarcely indented anterior; of similar length to apophysis anterior or slightly longer; without minute spines. Ductus bursae usually merging indistinguishably with elongate corpus bursae. Signum extremely small, sometimes apparently absent.

REMARKS. In less than 2 per cent of the specimens examined the veins *Rs* and M_1 are on a short common stalk in one or both hind wings. The frenulum consists of three setae (five females examined). In the male genitalia, the uncus and tegumen posterior tend to be narrower than in *flavella*. The corpus bursae of the female genitalia is extremely flimsy and sometimes very small.

M. eburnella closely resembles *flavella, aflavella* and *pallidipulchra* in the wing pattern, although it is usually slightly more contrasted in *eburnella*. It differs from these in the pointed apex of the sacculus together with the relatively short filament of the male genitalia, and the straight antrum without an indented apex in the female genitalia.

M. eburnella was described from an unspecified number of specimens. Zeller (1847: 848) refers to two specimens of this species in the Schiffermüller collection, which is now lost. I designate a male neotype from the type-locality, Austria: Wien area.

BIOLOGY. Host-plants: Trifolieae: *Medicago sativa* L., *M. lupulina* L. (Lhomme, [1948-1949]: 652); *M. polymorpha* L. (Bur clover), *Trifolium repens* L. (variety – Ladino clover), *T. hirtum* Hall (Rose clover); Vicieae: *Vicia americana* Muhlenberg (Purple vetch) (California Department of Agriculture unpublished report); Coronilleae: *Hippocrepis comosa* L. (Lhomme, [1948–1949]: 652).

The records of the California Department of Agriculture refer to the species in U.S.A.; the other records are European. I have seen a Walsingham specimen bred from '*Trifolium*'; however, this name has been used broadly and may refer to *Medicago*. A record of the species on *Populus* (Salicaceae) (Hofmann, 1875: 118) is erroneous since it is based on a misidentification of the moth which was probably *Schiffermuelleria formosella* [Denis & Schiffermüller] (Chrétien *in* Lhomme, [1948–1949]: 652).

The larva has been found in April and May, both in Europe (Lhomme, [1948–1949]: 652) and in U.S.A. (California Department of Agriculture unpublished report). This species has caused severe damage to clover in California, U.S.A., where the larva 'semiskeletonizes' leaves and lightly spins two leaves together, pupating inside the folded leaves (Anonymous, 1969: 69).

Moths have been collected from March to July (also in August according to Piskunov, 1981: 674); in May and June in U.S.A. Hartig (1964: 51) states that there are two generations in Italy, with the moths in June and August.

DISTRIBUTION. *M. eburnella* occurs in western, central and southern Europe south of *c.* 50° N. and extends to North Africa, the Middle East and U.S.S.R.: Armeniya. It is also found in U.S.A.: California where it is presumed to have been introduced.

According to the literature it has also been found in the following countries. Portugal (Zerkowitz, 1946: 132); Belgium (Lhomme, [1948–1949]: 652); Netherlands (Lempke, 1976: 27); Sardinia (Hartig & Amsel, 1951: 86); Poland (Schille, 1931: 199); Czechoslovakia (Hrubý, 1964: 293); Bulgaria (Rebel, 1903: 332); Crete (specimen in NM, Sattler, pers. comm.); U.S.S.R.: European part (Piskunov, 1981: 674).

MATERIAL EXAMINED (including 7 ♂, 10 ♀ genitalia preparations)

Neotype ♂ (*eburnella*), **Austria**: Nieder-Österreich ('Austr. inf.'), [near Wien,] Klosterneuburg, 2.vi.1918 ('Freiberg') genitalia slide no. 11230; NM).

Spain: 6 ♂, Granada; 1 ♂, Mallorca; iv–vi. **France**: 1 ♂, 1 ♀, Sarthe (MNHN); 1 ♂, SW.; vii. **Germany**: 3 ♂. **Switzerland**: 2 ♂, 3 ♀, Valais. **Corsica**: 19 ♂, 7 ♀, v–vii. **Italy**: 2 ♂, 1 ♀, Toscana; 1 ♂, Lazio; 1 ♂, Campania; iv–vi. **Sicily**: 5 ♂, 4 ♀, 5 ex., iii–v. **Austria**: 1 ♂, 2 ♀, —; 1 ♂, Wien area (NM); vi. **Yugoslavia**:

1 ♂, 1 ♀, Slovenija; 3 ♂, 1 ♀, Croatia; 1 ♂, 1 ♀, Dalmatia; 2 ♂, Bosna i Hercegovina; vi, vii. **Hungary**: 4 ♂, —. **Rumania**: 6 ♂, Timiş, vi (BMNH; NM); 1 ♂, Caras-Severin, vi? (NM). **Albania**: 2 ♂, vii. **Greece**: 1 ♀, Levkás, vi (NM); 1 ♂, Lakonia, iv (ZM); 1 ♂, 1 ♀, Ródhos I., iv. **Cyprus**: 4 ♂, 3 ♀, 1 ex., iv, v. **Turkey**: 1 ♀, Bursa (NM); 1 ♂, Toros Dağlari. **Malta**: 1 ♂, 1 ♀, iv. **Morocco**: 2 ♂, 1 ♀, iv, v. **Algeria**: 7 ♂, 3 ♀, Oran province; 2 ♀, Algiers province (BMNH; MNHN); 13 ♂, 6 ♀, Constantine province; v, vi. **Tunisia**: 3 ♂, 3 ♀, iv, v. **Egypt**: 2 ♂, —; 1 ♀, Cairo area, iv (NM) (Rebel, 1914: 268, as *Rhinosia palidipulchra* Walsingham). **Israel** [including Jordan west bank territories]: 4 ♂, 5 ♀, 'Palestine'; iv, v. **Lebanon**: 4 ♂, v. **Syria**: 2 ♀, N.; 2 ♂, 2 ♀, NW. **U.S.S.R.**: 1 ♀, Armeniya, vii (NM). **U.S.A.**: 6 ♂, 4 ♀, California, v, vi. No locality data: 37 ex.

The *interuptella*-group

♂, ♀. Fore wing without zig-zag pattern of yellowish markings; sometimes with median longitudinal stripe. Hind wing with veins *Rs* and M_1 on common stalk as in Fig. 4.

GENITALIA ♂. Uncus usually small or constricted at base; occasionally large. Gnathos a large or small simple hook or modified in shape. Tegumen without pair of lateral processes. Filament-supporting sclerites not crossed or spiralled round each other. Hind edge of vinculum a narrow projection or with distinctly demarcated, usually narrow, median projection. Vinculum with pair of sclerites or single sclerite extending from saccus and approaching hind edge of vinculum.

GENITALIA ♀. One invagination of membrane between eighth segment and papillae anales present, comparatively sturdy, usually between tergite and papillae anales (between sternite and papillae anales in *interuptella*). Eighth segment usually moderately to strongly sclerotized. Apophysis anterior rod-like or very short, broad lobe; usually short. Signum, if present, with many small spines or without spines.

REMARKS. In some species occasional specimens have the veins *Rs* and M_1 separate in one or both hind wings. In *mulinella* the lateral edge of the male tegumen is sometimes wavy, producing slight projections but not the distinct rounded processes of the *maculatella*-group. The sclerotization of the female eighth segment is limited to small areas in *fasciata* and, particularly, *ocellinella*; the degree of sclerotization is greater in *lentiginosella* and *cytisella* but still slightly less than in the rest of the *interuptella*-group. The species in this group are more diverse in genitalia structure than those of the *maculatella*-group.

BIOLOGY. Host-plants: Genisteae (*cytisella* also on Trifoliae: *Ononis*).

Mirificarma ocellinella (Chrétien) **comb. n.**

(Figs 1, 2, 15, 16, 46, 71, 83, 94, 95)

Gelechia ocellinella Chrétien, 1915: 317. LECTOTYPE ♀, TUNISIA (MNHN), here designated [examined].
Gelechia aurantiella Chrétien, 1915: 317. LECTOTYPE ♀, TUNISIA (MNHN), here designated [examined]. **Syn. n.**
Gelechia retamaeofoliella Dumont, 1931: 148. LECTOTYPE ♀, TUNISIA (MNHN), here designated [examined]. **Syn. n.**

♂, 9·0–11·0 mm. ♀, 8·5–10·5 mm. Head cream to light brown. Labial palpus cream mottled with brown, sometimes dark brown, particularly on outer surface; second segment with slight to moderate brush below. Thorax and tegula cream to mid brown; tegula sometimes darker at base. Fore wing (Figs 15, 16) cream to light brown, sometimes mottled with darker brown; usually with narrow longitudinal dark brown stripes radiating to apical wing margin. Median stripe sometimes overlaid with broader median longitudinal band, occasionally very dark. Tiny spot sometimes present at one-third to half, on costal edge of cell, and occasionally at or near end of cell.

GENITALIA ♂ (Figs 46, 71). Uncus large, two-thirds to nearly three-quarters width of tegumen. Gnathos basal half increasingly very broad then narrowing sharply to hook-shaped apical half. Actual margin of tegumen slightly less emarginate than sclerotized margin anteriorly. Sacculus very slightly S-curved, usually moderately slender, apex slightly wrinkled and with small irregular projections. Filament very moderately stout, almost straight; extending beyond apex of valva posteriorly, and very far beyond tegumen anteriorly. Tiny tube projecting from opening near filament apex. Hind edge of vinculum with sharply rectangular weakly sclerotized, scarcely emarginate, median projection. Vinculum short, with pair of almost parallel sclerites. Saccus parallel-sided, moderately slender, apex not or scarcely wider than base; extremely long but not reaching anterior of filament. Aedeagus slightly less than twice length of tegumen plus uncus; apex with very narrow, distinctly sclerotized, slightly projecting structure.

GENITALIA ♀ (Figs 94, 95). Abdomen with at most faint median longitudinal band, scarcely more distinct at posterior margin of seventh segment. Invagination of membrane between eighth tergite and papillae anales funnel-shaped. Eighth sternite with lateral pair of relatively narrow longitudinal sclerotized strips; tergite and rest of sternite weakly sclerotized and faintly wrinkled longitudinally. Unsclerotized median area of sternite at least as wide as each sclerotized area. Apophyses anteriores parallel, rod-like, length 1·0–1·3 mm (7); apophysis posterior three to four times length of apophysis anterior. Pair of membraneous sacs from sternite between apophyses anteriores and antrum, densely covered in minute spines. Antrum gently coiled, anterior not indented; extremely long, coiled length approximately twice length of apophysis anterior. Ductus bursae less than half length of oval or round corpus bursae. Signum strongly curved inwards, elongate-oval, distinctly covered with tiny spinules; with spiny-edged plate, usually medially indented, projecting obliquely inside bursa.

REMARKS. The fore wing pattern of *ocellinella* varies by degrees from strongly contrasted markings to the comparatively uniform fore wing of the type-specimens of *retamaeofoliella*, which lacks stripes. The frenulum of six out of seven females examined consists of three setae; in the remaining female it consists of two setae. In the male genitalia the tiny tube near the apex of the filament was not visible in two specimens; however, it is easily lost during the preparation of the genitalia. The specimens examined show a wide but gradual range both in wing length and in the female sternite sclerotization. The lectotype of *G. retamaeofoliella* is the smallest specimen of *ocellinella* and has the shortest strips of sternite sclerotization. The signum of this specimen is more elongated than others examined and the projection of the signum has no median indentation.

M. ocellinella is the largest species of the genus. It closely resembles *fasciata* in the male and female genitalia, but differs in the shape of the male gnathos and saccus, and to a less extent in the female sternite sclerotization and signum.

M. ocellinella was described from an unspecified number of specimens from Tunisia. I designate the single type-specimen I have examined as the lectotype. The collector is likely to have been Chrétien but may have been Oberthür or Lucas (Chrétien, 1915: 289).

G. aurantiella was also described from an unspecified number of specimens from Tunisia. I have examined a single specimen labelled 'TYPE' [by Viette], '*Gelechia aurantiella*'. It bears the locality label 'Mansour', not 'Gafsa' as cited in the original description; however, there is a locality of this name near Gafsa. Despite this discrepancy, I consider it to be a type-specimen and designate it as the lectotype.

G. retamaeofoliella was described from a pair of specimens from Tunisia, both of which I have examined. They are labelled 'Coll. D. Lucas, 1952' and in Lucas's handwriting: '*Gelechia retamaeofoliella* Dumont' on the female and '*Gelechia acupediella* Frey' on the male. The specimens are conspecific and the label on the male is incorrect. According to Dr P. Viette (pers. comm.) the type-specimens, which are in the MNHN, belong to the Dumont Collection, not the Lucas Collection, and Lucas may have replaced their original labels. I designate the female as the lectotype.

The type-specimens of *retamaeofoliella* represent the small, poorly-marked form of *ocellinella*.

BIOLOGY. Host-plant: Genisteae: *Retama raetam* (Forskål) Webb & Berthelot (*R.* '*retem* Webb') (type-series of *G. retamaeofoliella*). The larva remains in a long silk tube at the base of the food-plant during the day and comes out to feed on the leafy branches at night (Dumont, 1931: 149). It is fully grown at the beginning of March and the adults Dumont reared emerged in September and October. Moths have been found in January, March to May and September to November. A few females have been collected at light.

DISTRIBUTION. Morocco, Algeria, Tunisia, Libya, Jordan.

MATERIAL EXAMINED (including 7 ♂, 7 ♀ genitalia preparations)

Lectotype ♀ (*ocellinella*), **Tunisia**: Tozeur, 31.x.1904 (genitalia slide no. 28, LMP.; MNHN). Lectotype

♀ (*aurantiella*), **Tunisia**: [Gafsa], Mansour, 11.xi.1908 (genitalia slide no. 29, LMP; MNHN). Lectotype ♀ (*retamaeofoliella*), **Tunisia**: Metlaoui, larva on *Retama* '*retem* Webb', moth emerged 9.x.1921 (*Dumont*) (genitalia slide no. 39, LMP; MNHN).

Morocco: 1 ♂, Agadir, 'Rocksin', xi (NM). **Algeria**: 1 ♂, S. Oran, Aflou region, x; 3 ♂, Lambèse, x. **Tunisia**: 1 ♂ (*retamaeofoliella* paralectotype), Metlaoui, on *Retama* '*retem* Webb' (MNHN); 1 ♀, Kasserine to Thélepte road, iv (MNHN); 1 ♂, 1 ♀, 1 ex., Bū Hadmah ('Bou Hedma'), iii, x, (MNHN); 6 ♂, 4 ♀, Maknassy, x, xi (MNHN). **Libya**: 1 ♀, W. ('occ.') Sirtica, Sawfajjin ('Sofeggin'), v; 1 ♂, W. ('occ.') Sirtica, Al Qaddāḩīyah ('Gheddahia'), ix. **Jordan**: 1 ♀, Jordan Valley, Zarqa ('Zerqa') R. Colony, *c.* 100 m below sea level, i.

Mirificarma fasciata sp. n.

(Figs 1, 2, 17, 47, 70, 96)

♂, ♀, 8·5 mm. Head white mottled with grey. Labial palpus white mottled with grey; mainly grey on outer surface. Thorax mottled grey and white; tegula grey. Fore wing (Fig. 17) white and ochreous cream, mottled with dark brown scales mainly near wing margins; very faintly and diffusely forming longitudinal narrow stripes radiating from base towards apex. Brown median longitudinal band, very dark brown on costal side. Very narrow, broken, dark brown stripe along fold to dorsal margin.

Genitalia ♂ (Figs 47, 70). Uncus large, approximately two-thirds width of tegumen. Gnathos long and only slightly curved; basal half unmodified, extreme apex a very slight hook-shape. Actual margin of tegumen slightly less emarginate than sclerotized margin anteriorly. Sacculus straight, slender; extreme apex with small irregular projection. Filament straight, very moderately stout; reaching apex of valva posteriorly, extending far beyond tegumen anteriorly. Hind edge of vinculum with sharply rectangular, weakly sclerotized, scarcely emarginate median projection. Vinculum short, with pair of parallel sclerites. Saccus slender, parallel-sided except apex which is twice width of base; extremely long, extending beyond filament anteriorly. Aedeagus slightly less than twice length of tegumen plus uncus; apex with very narrow, distinctly sclerotized, slightly projecting structure.

Genitalia ♀ (Fig. 96). Posterior margin of seventh abdominal segment with area of weak dorsal sclerotization and pair of faint ventral patches merging with extremely faint median longitudinal band. Invagination of membrane between eighth tergite and papillae anales conical. Eighth sternite with lateral pair of broad longitudinal sclerotized strips; tergite and rest of sternite weakly sclerotized and very slightly wrinkled longitudinally. Less sclerotized median area of sternite narrower than each sclerotized area. Apophyses anteriores parallel, rod-like, length 0·7 mm (1); apophysis posterior twice length of apophysis anterior. Small pair of membraneous sacs from sternite between apophyses anteriores and antrum, densely covered in minute spines. Antrum coiled; anterior not indented; extremely long, actual length approximately three to four times length of apophysis anterior. Ductus bursae less than half length of oval corpus bursae. Signum moderately elongate-oval, with irregular surround and small inwards projection which is medially indented; covered with tiny spinules.

Remarks. The frenulum of the single female examined consists of two setae on one wing and three on the other. The longitudinal fore wing stripe of this species gives it a superficial resemblance to *interuptella* although the stripe is more diffuse than in the latter. However, it differs considerably in the genitalia, particularly in the shape of the male filament, saccus and sacculus, and in the female apophysis anterior and antrum. *M. fasciata* is also similar externally to specimens of *ocellinella* with a fore wing stripe and the two species appear to be closely related. It differs from *ocellinella* in the shape of the male gnathos and saccus and in the female, to a lesser degree, in the sternite sclerotization and the signum shape.

Biology. Host-plant unknown. Moths have been found in December.

Distribution. Spain.

Material examined (including 1 ♂, 1 ♀ genitalia preparations)

Holotype ♂, **Spain**: [Malaga,] San Pedro de Alcántara, xii.1972 (*Ffennell*) (genitalia slide no. 22083). Paratype. 1 ♀, same data as holotype.

Mirificarma lentiginosella (Zeller)

(Figs 1, 2, 18, 44, 72, 97)

[*Haemylis obscurella* Hübner; Treitschke, 1832: 240–241 (larva only). Misidentification.]
Gelechia lentiginosella Zeller, 1839: 198; Stainton, 1865: 64, pl. 2, fig. 3. LECTOTYPE ♀, GERMANY (EAST) (BMNH), here designated [examined].

♂, 6·5–8·5 mm. ♀, 6·0–8·0 mm. Head mid to dark brown. Labial palpus dark brown with scattered cream scales; paler on dorsal or inner surface and at segment apices. Thorax and tegula mid to dark brown. Fore wing (Fig. 18) dark brown with scattered pinkish buff scales; small pinkish spot at costa, at two-thirds to three-quarters, sometimes extended to basal margin. Very small darker brown spots with ochreous surround; one in fold, one in cell, both approximately at one-third; one at end of cell. All spots indistinct.

GENITALIA ♂ (Figs 44, 72). Uncus large, slightly constricted at base, at this point half to two-thirds width of tegumen, otherwise slightly narrower than tegumen. Gnathos a large simple hook. Actual margin of tegumen slightly less emarginate than sclerotized margin anteriorly. Sacculus moderately curved inwards, with evenly rounded apex; slender. Filament almost straight basally, without median lobe, with strong kink at apex, very moderately stout; extending posteriorly to hind edge of vinculum or slightly beyond; extending well beyond tegumen anteriorly. Hind edge of vinculum with low, weakly sclerotized median projection not emarginate ventrally. Vinculum with pair of sclerites, parallel or converging and undulating from saccus, almost reaching hind edge of vinculum. Saccus parallel-sided or broader at rounded apex, very long, extending far beyond tegumen anteriorly. Aedeagus approximately 1·5 times length of tegumen plus uncus, with moderately small apical projection.

GENITALIA ♀ (Fig. 97). Abdomen with at most faint, patchy, median longitudinal band scarcely more distinct at posterior margin of seventh segment. Invagination of membrane between eighth tergite and papillae anales long and narrow. Eighth segment not usually strongly sclerotized. Sternite with lateral pair of very broad, longitudinal sclerotized areas; median area of sternite less sclerotized, usually slightly, and narrower than each lateral area of sternite. Tergite with medially expanded sclerotized area at anterior and pair of tiny lateral patches at posterior. Apophyses anteriores diverging, rod-like, length 0·4–0·5 mm (8); apophysis posterior four to five times length of apophysis anterior; without sacs between apophyses anteriores and antrum. Antrum gently coiled or strongly curved, anterior not indented; extremely long, coiled extent two to four times length of apophysis anterior. Ductus bursae usually not more than half length of round corpus bursae. Signum small, oval, weakly sclerotized, slightly curved inwards, covered with tiny spinules.

REMARKS. In six females examined, the frenulum consists of three setae, except for one female in which it consists of four on one wing.

M. lentiginosella differs in the fore wing pattern of very small indistinct spots on a dark background, although this is very occasionally approached by extremely dark specimens of the externally variable *mulinella*. *M. lentiginosella* can be distinguished by the shape of the male filament, which is straight basally, kinked apically and without a lobe, and by the very long antrum together with the diverging apophyses anteriores in the female. This species appears to be close to *constricta* with which it has some common features of the uncus, filament and sacculus. However, the uncus and filament shape are similar in *interuptella*, although to a lesser degree.

M. lentiginosella was described from a series of 25 specimens of which I designate as lectotype the single specimen I have examined, which was already labelled 'lectotype' by Sattler. The type-locality is neither stated in the original description nor on the lectotype label. The original description attributes the species name to Tischer, and I have seen a record, in Tischer's handwriting, of the species collected in Dresden (East Germany). It seems most likely that the specimens from Dresden referred to in Tischer's record were sent to Zeller and that Zeller based his description on these.

BIOLOGY. Host-plants: Genisteae: *Genista tinctoria* L. (larvae and moths bred by Bankes and Ford, Great Britain; Stainton, 1865: 64); *G. anglica* L. (moths bred by Nielsen, Denmark; Sorhagen, 1886: 186); *G. germanica* L., *G. sagittalis* L. (Sorhagen, 1886: 186); *Laburnum anagyroides* Medicus (= *Cytisus laburnum* L.) (Müller-Rutz, 1913–1914: 485).

Records of *Centaurium erythraea erythraea* Rafn (= *Erythraea centaurium* Persoon) (Gentianaceae) (Lhomme, [1946–1948]: 607, 'according to certain authors') and *Salix repens* L. ? (Salicaceae) (Sorhagen, 1886: 187) are extremely dubious as host-plants of this species. Sorhagen attributes his record to Hartm[ann] but I have not been able to trace the reference.

The larva occurs in May and June, spinning together the young terminal shoots of the plant; it pupates in a cocoon amongst leaves on the ground (Stainton, 1865: 64), from June to July (Bradford, [1979]: 123). Moths have been collected from June to August (also in May according to Mariani, 1943: 167).

DISTRIBUTION. Great Britain, France, Denmark, Central Europe, Italy, Rumania.

Additional records. Spain (Agenjo, 1968: [4]); Netherlands (Lempke, 1976: 26); Sweden (Krogerus *et alii*, 1971: 21); Poland (Schille, 1931: 176); Czechoslovakia (Nickerl, 1908: 20); Yugoslavia (Mariani, 1943: 167); Hungary (Gozmány, 1958: 227); Turkey (Klimesch, 1961: 648); U.S.S.R.: European part (Piskunov, 1981: 672); U.S.S.R.: Armeniya (Rebel, 1901: 14).

MATERIAL EXAMINED (including 8 ♂, 8 ♀ genitalia preparations)

Lectotype ♀, [**Germany (East)**: Dresden], larva on *Genista tinctoria*, ex viii (genitalia slide no. 22492).

Great Britain (England): 67 ex., —; 2 ex., Worcester: 15 ♂, 13 ♀, 3 ex., Dorset; 1 ex., New Forest; 12 ex., Isle of Wight; 52 ex., Sussex; 8 ex., Kent; 7 ex., Essex; vii–viii. **France**: 1 ♂, Basses Alpes; 1 ♀, Alpes-Maritimes, viii. **Denmark**: 3 ♂, 1 ♀, Jylland, vi (BMNH; ZM). **Germany (West)**: 4 ♂, 1 ♀, Niedersachsen; 1 ♂, Bayern, viii. **Germany (East)**: 6 ♂, 3 ♀, 1 ex., Gera. **Switzerland**: 1 ♂, Zurich. **Italy**: 1 ♀, Toscana, viii. **Austria**: 2 ♂, 1 ♀, Wien, viii (NM). **Rumania**: 1 ♂, 1 ♀, Cluj, viii (MINGA). No locality data: 34 ex.

***Mirificarma constricta* sp. n.**

(Figs 1, 2, 19, 45, 73)

♂, 5·5–6·0 mm. Head mid brown. Labial palpus mottled cream and brown. Thorax and tegula mid brown. Fore wing (Fig. 19) mottled mid brown, slightly darker at base. Dark brown spot across fold at one-third extending to dorsal margin. Small dark brown spot at end of cell.

GENITALIA ♂ (Figs 45, 73). Uncus small, slightly more than half width of tegumen, strongly constricted at base. Gnathos large, only moderately curved; extreme apex a very slight hook-shape. Actual margin of tegumen slightly less emarginate than sclerotized margin anteriorly; sclerotized margin X-shaped medially. Sacculus moderately S-curved; with evenly pointed apex, moderately slender. Filament basal half straight, very broad dorsoventrally and compressed laterally; median lobe projecting ventrally; apical half more slender, kinked; extending beyond hind edge of vinculum posteriorly, and moderately beyond tegumen anteriorly. Median projection of hind edge of vinculum with ventral V-shaped emargination; dorsally deeply U-emarginate. Vinculum with pair of sclerites converging from saccus, almost reaching hind edge of vinculum. Saccus moderately broad, parallel-sided or slightly bow-sided, with rounded apex; extending slightly beyond tegumen anteriorly. Aedeagus same length as tegumen plus uncus or slightly shorter; projection near apex slight.

GENITALIA ♀. Unknown.

REMARKS. *M. constricta* is very similar in fore wing pattern to *cabezella* and, to a less extent, *scissella* and *rhodoptera* but differs in the constricted uncus and the shape of the filament. *M. constricta* resembles *lentiginosella* in these male genitalic characters; however, the single known female of *constricta* lacks the abdomen and it is impossible to be certain of its relationships.

BIOLOGY. Host-plant unknown. Moths have been found in August and October.

DISTRIBUTION. Northern Morocco.

MATERIAL EXAMINED (including 2 ♂ genitalia preparations)

Holotype ♂, **Morocco**: Tanger, 45 m, 30.x.1934 (*Querci*) (genitalia slide no. 7477).

Paratypes. **Morocco**: 1 ♂, 1 ♀, Tanger, 45 m, 30.viii, 24.x.1934 (*Querci*).

Mirificarma cytisella (Treitschke)

(Figs 1, 2, 5, 20, 21, 48, 74, 75, 98, 110)

Lita cytisella Treitschke, 1833: 99.

♂, 6·0–8·0 mm. ♀, 6·0–7·5 mm. Head white to cream, eye socket edged with dark brown anteriorly. Labial palpus white to cream, with dark brown predominantly on outer surface of first segment and outer, basal two-thirds of second segment. Thorax and tegula white to cream with scattered brown scales. Fore wing (Figs 20, 21) white to cream, mottled, sometimes sparsely, with brown scales, usually slightly darker in apical fifth. Costa darker at base. Indistinct, narrow, transverse cream streak basal to apical fifth. Brown wedge-shaped spot, usually dark, across fold at one-third extending to dorsal margin. Smaller dark brown spot, sometimes bisected, at end of cell. Dark spots often with narrow ochreous surround.

GENITALIA ♂ (Figs 48, 74, 75). Uncus small, narrowing progressively from tegumen, with tiny, pointed median projection at apex. Gnathos small, hook-shaped, with median spine on anterior surface. Actual margin of tegumen coincides with or slightly less emarginate than sclerotized margin anteriorly. Sacculus very small, hook-shaped. Filament slightly, sometimes irregularly, curved; moderately slender, gradually broader at base; almost reaching hind edge of vinculum or extending moderately short distance beyond, posteriorly; extending short distance beyond tegumen anteriorly. Hind edge of vinculum projecting slightly, medially; projection with truncate or irregular apex ventrally, slightly emarginate dorsally. Vinculum with pair of sclerites parallel or slightly diverging from saccus. Saccus almost parallel-sided, usually with truncate apex; almost reaching anterior of tegumen. Aedeagus of similar length to tegumen plus uncus; projection near apex small.

GENITALIA ♀ (Figs 98, 110). Posterior margin of seventh abdominal tergite with well-defined crescent of sclerotization. Invagination of membrane between eighth tergite and papillae anales funnel-shaped. Eighth sternite sclerotized laterally; median area with sclerotization often weaker and patchy. Tergite very weakly sclerotized. Apophysis anterior rod-like, length 0·4 mm (7); apophysis posterior approximately three times length of apophysis anterior. Antrum extremely short. Ductus bursae usually of similar length to, or slightly longer than, pear-shaped or oval corpus bursae. Signum a narrow, inwards-projecting ridge, with faint surrounding area of sclerotization.

REMARKS. The frenulum of five out of seven females examined consists of two setae; in the remaining two it consists of three setae on one wing and two on the other.

Specimens from Portugal, the extreme west of the range, differ in fore wing pattern from specimens from France eastwards and were described as subspecies *leonella*. Examination of material from intermediate localities, particularly in Spain, is necessary to decide whether subspecific status is justified.

M. cytisella has two forms of male genitalia. In the typical form of *c. cytisella*, the filament extends distinctly beyond the hind edge of the vinculum and is usually gently and evenly curved, or almost straight excluding the base. In other specimens of *cytisella*, including *c. leonella*, the filament scarcely extends beyond the hind edge of the vinculum and is usually more irregularly curved. The spine on the gnathos is usually shorter in the typical form than in the other specimens of *c. cytisella*, which I am referring to as the small form, or in *leonella*. The small form of *c. cytisella*, and *leonella*, have smaller male genitalia than the typical form of *c. cytisella*. In the female genitalia, the signum varies from small to large but without apparent correlation with the two forms of male genitalia. I have assigned the females to each form of *c. cytisella* on the basis of geographic association with the males.

It is possible that the small form of *c. cytisella* could be a separate subspecies from the typical form, and might be more closely allied to *leonella* since the small form and *leonella* are similar in genitalia structure. However, the small form has a widely disjunct distribution, populations occurring both west and east of the typical form, thus it seems unsatisfactory to consider it a distinct subspecies.

The fore wing spots of *cytisella*, other than in *leonella*, are usually more distinct than in the other species of *Mirificarma*, except *maculatella* and *denotata* which have larger spots. *M. cytisella* can be distinguished from the other species of the genus by the small hook-shaped sacculus, the spine of the gnathos, and the form of the signum.

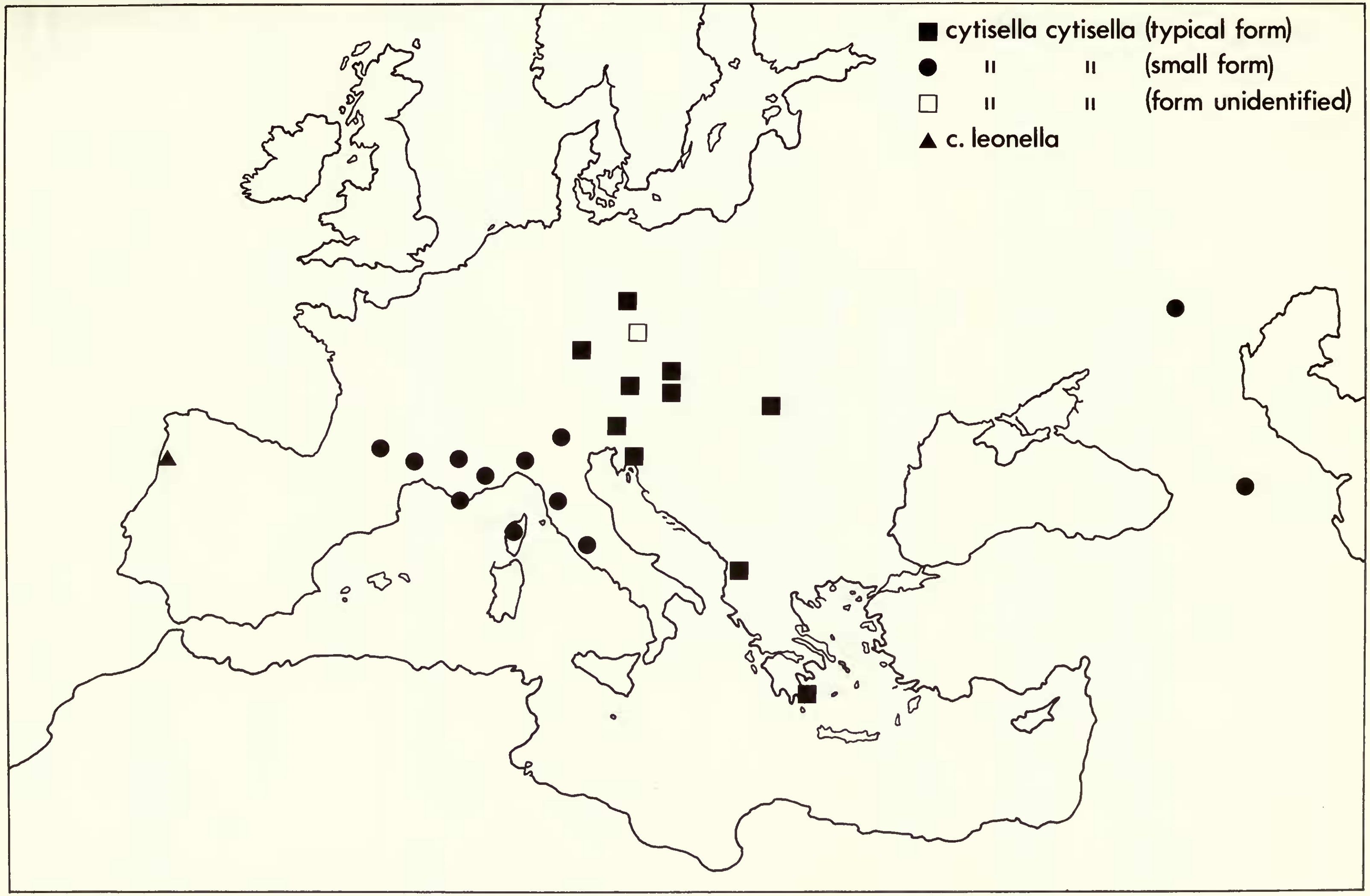
■ cytisella cytisella (typical form)
● " " (small form)
□ " " (form unidentified)
▲ c. leonella

Fig. 5 Distribution map of the subspecies and forms of *Mirificarma cytisella* (Treitschke).

Biology. Host-plants: Genisteae: *Cytisus nigricans* L. (Treitschke, 1833: 100); *Genista* (Schütze, 1931: 120 attributes this to an untraced record by Disqué); *Laburnum anagyroides* Medicus (= *Cytisus laburnum* L.), *Calicotome spinosa* (L.) Link and Trifolieae: *Ononis spinosa spinosa* L. (= *campestris* Koch & Ziz) (Lhomme, [1946–1948]: 592; the record of *L. anagyroides* is based on the proximity of the moths to the plant and requires the confirmation of bred specimens).

A record of *Daphne* (Thymelaeaceae) (Mariani, 1943: 168) as a host-plant is probably erroneous.

The larva occurs in June, September and October within two or three spun leaves and the pupal stage is from October to April (Treitschke, 1833: 100; Lhomme, [1946–1948]: 592; Eckstein, 1933: 134). Moths have been collected from April to September.

Distribution (Fig. 5). France, Germany, Corsica, Italy, Austria, Yugoslavia, Czechoslovakia, Hungary, Albania, Greece, U.S.S.R.

Additional records from the literature: Spain (Agenjo, 1968: [4]); Switzerland (Müller-Rutz, 1914: 489); Poland (Schille, 1931: 179).

Key to the subspecies

1 Spot across fold of fore wing dark, strongly contrasting with background .... ***c. cytisella*** (p. 36)
– Spot across fold of fore wing not strongly contrasting with background .... ***c. leonella*** (p. 37)

Mirificarma cytisella cytisella (Treitschke)

(Figs 5, 20, 48, 75, 98, 110)

Lita cytisella Treitschke, 1833: 99. LECTOTYPE ♀, Germany (East) (TM), here designated [examined].
Gelechia cytisella Treitschke ab. *roseella* Hauder, 1918: 102. [Unavailable, infrasubspecific name.]

♂, 6·0–8·0 mm. ♀, 6·0–7·5 mm. Fore wing (Fig. 20) with mottled brown darker at costa in four-fifths. Wedge-shaped spot across fold dark brown, strongly contrasting with background, usually unbroken.

Genitalia ♂ (Figs 48, 75). Filament almost reaches or extends beyond hind edge of vinculum.

	Typical form	Small form
Tegumen plus uncus length	1·2–1·3 mm (14)	1·0–1·1 mm (10)
Filament length	1·2–1·3 mm (14)	0·8–0·9 mm (10)
Filament length/tegumen plus uncus length	1·0 mm (14)	0·7–0·9 mm (12)

Genitalia ♀ (Figs 98, 110). As described on p. 34.

Remarks. The nominate subspecies differs from *c. leonella* in the more strongly contrasting fore wing pattern of the former.

M. c. cytisella was described from an unspecified number of specimens. I designate as lectotype the single type-specimen I have examined, which was already labelled 'lectotype' by Karsholt.

Biology. Host-plants as described on p. 36. Moths of the typical form have been found from April to August; those of the small form have been found from May to September.

Distribution (see Fig. 5). Typical form: Germany, Austria, Yugoslavia, Hungary, Albania, Greece. A pair of specimens from the Meyrick Collection, bearing the data 'France: Ardèche', may have been mislabelled.

Small form: France, Corsica, Italy, U.S.S.R.

Form unidentified: Czechoslovakia.

Material examined

Typical form (including 14 ♂, 5 ♀ genitalia preparations)

Lectotype ♀ (*cytisella*), **Germany (East)**: Meissen, highlands, larva on *Cytisus nigricans,* ix, ex iv (*von Tischer*) (TM).

France: 1 ♂, 1 ♀, Ardèche. **Germany**: 3 ♂, 1 ♀, S. **Germany (West)**: 1 ♀, Regensburg ('Ratisbon'); 2 ♂, Bavaria. **Austria**: 1 ♂, [Kärnten,] Ofen; 2 ♂, 1 ♀, Ober-Österreich, Linz area, iii ?, vii (LN; NM); 2 ♀, Nieder-Österreich, Wiener Wald, Leopoldsberg, vi (NM); 1 ♂, Mödling; 1 ♀, Nieder-Österreich, Klosterneuburg, iv (NM); 1 ♂, Nieder-Österreich, Falkenstein, vi. **Yugoslavia**: 1 ♂, Rijeka ('Fiume') (NM); 1 ♀, Istra ('Istria'), 'Sin', iv (NM); 2 ♀, Zadar ('Zara'), viii (NM). **Hungary**: 1 ♂, near Debrecen, Ermihalyfalva, v (NM) (Rothschild, 1913: 80). **Albania**: 1 ♂, [NE], Kula Ljums, vi (NM) (Rebel, 1931: 146). **Greece**: 1 ♂, Lakonia, 5 km S. of Monemvasía, iv (ZM).

Small form (including 13 ♂, 4 ♀ genitalia preparations)

France: 1 ♂, Lot, Douelle, vii (MNHN); 1 ♂, Ste Croix-Vallée-Française, vii (MNHN); 1 ♂, Hautes-Alpes, St Julien-en-B[eauchène], vii; 1 ♂, Hyères; 1 ♀, Hyères, v (MNHN); 1 ♂, 1 ♀, Alpes-Maritimes, St Martin, 1500 m, vi. **Corsica**: 3 ♂, 1 ♀, Evisa, 850 m, viii, ix (NM). **Italy**: 1 ♂, Piemonte, 'Valle di Poggio di' Casasco, v; 1 ♀, Piemonte, Monferato, Cardona, v; 1 ♂, Trentino-Alto Adige, Pietramurata, 250 m, viii; 1 ♀, Trentino-Alto Adige, Val Sarca, Pietramurata, 250 m, vii (all coll. Jäckh, Bidingen); 1 ♂, Toscana, Fiesole, vii; 1 ♂, Rome (MNHU). **U.S.S.R.**: 4 ♂, [S. of Volgograd,] Krasnoarmeysk ('Sarepta'), viii; 1 ♂, Bol'shoy Kavkaz ('Caucasus'), Tbilisi ('Tiflis'), v.

Form unidentified (including 1 ♀ genitalia preparation)

France: 1 ♀, Le Rozier, vii (MNHN); 1 ♀, Hérault, 'St Guilhem-le-Dt' (MNHN). **Italy**: 2 ♀, [Friuli Venezia], Raibl (NM). **Czechoslovakia**: 2 ♀, Bohemia; 1 ♀, Praha ('Prag') (MNHU). No locality data: 4 ♂, 6 ♀.

Mirificarma cytisella leonella Amsel

(Figs 5, 21, 74)

Mirificarma [Gelechia] cytisella leonella Amsel, 1959: 156, 164, pl. 1, fig. 3. Holotype ♂, PORTUGAL (LN) [examined].

♂, 6·5–7·5 mm. Fore wing (Fig. 21) with mottled brown slightly darker in four-fifths. Wedge-shaped spot across fold not strongly contrasting with background, usually broken.

GENITALIA ♂ (Fig. 74). Filament does not extend beyond hind edge of vinculum.

Tegumen plus uncus length	0·9–1·0 mm (3)
Filament length	0·7–0·8 mm (3)
Filament length/tegumen plus uncus length	0·8–0·9 mm (3)

GENITALIA ♀. Not examined.

REMARKS. *M. c. leonella* differs from the nominate subspecies in the less strongly contrasting fore wing pattern of the former.

BIOLOGY. Host-plant unknown. Moths have been found in June (also in August according to Amsel, 1959: 157).

DISTRIBUTION. Portugal.

MATERIAL EXAMINED (including 3 ♂ genitalia preparations)

Holotype ♂, Portugal: [40 km N. of Porto,] Singeverga, vi.1953 (*Monteiro*) (only genitalia slide, no. 323c, Sattler, examined; LN) (labelled 'spp. lusitaniella Ams.').

Portugal: 3 ♂ (paratypes), Singeverga, vi.1953 (*Monteiro*) (LN); 1 ♂ (paratype), Montalegre (*Monteiro*) (LN) (only genitalia slide examined).

Mirificarma monticolella (Rebel) **comb. n., stat. n.**

(Figs 1, 2, 22, 49, 57, 58, 76)

Lita acuminatella f. *monticolella* Rebel, 1931: 147, 160. LECTOTYPE ♂, ALBANIA (NM), here designated [examined].

♂, 6·5–7·0 mm. Head cream. Labial palpus third segment and apex of second segment cream, otherwise mid brown mottled with cream on inner surface. Thorax and tegula cream mottled with brown. Fore wing (Fig. 22) cream mottled with brown, predominantly cream in central area of wing; apex edged with small dark brown spots. Small dark brown spots, sometimes indistinct: spot or streak in fold near base, spot in fold at one-third, two on costal edge of cell and one at end of cell.

GENITALIA ♂ (Figs 49, 57, 58, 76). Uncus small, narrowing progressively from tegumen, without apical projection. Gnathos extremely short, without median spine. Actual margin of tegumen coincides with sclerotized margin anteriorly. Sacculus broad, particularly towards apex, club-shaped. Filament gently curved, very moderately stout; posteriorly extending to hind edge of vinculum or just beyond, scarcely extending beyond tegumen anteriorly. Hind edge of vinculum projecting medially with broad U-shaped emargination of sclerotization. Vinculum with pair of sclerites. Saccus very slender, wider at base than at pointed apex; not quite reaching anterior of tegumen. Aedeagus almost as long as tegumen plus uncus; projection near apex minute.

GENITALIA ♀. Unknown.

REMARKS. The small dark spots at the apex of the fore wing are also present in many other species but they are particularly distinct in *monticolella* and *interuptella* in which they contrast with the light ground colour. In the male genitalia, the sclerites of the vinculum appear faint, perhaps because the preparations are not stained.

This species bears a superficial resemblance to *montivaga* and some specimens of *ocellinella* which also have a pale fore wing with sparse dark markings. However, *monticolella* is smaller than *ocellinella* and *montivaga* has no fore wing markings other than the mottled ground colour. *M. monticolella* has many genitalic differences from both species, including the size of the male filament. *M. monticolella* can be distinguished from all other *Mirificarma* species by the extremely short gnathos and the very slender, short saccus.

M. monticolella was described from 2 ♂, both of which I have examined.

BIOLOGY. Host-plant unknown. Moths have been found in May or June.

DISTRIBUTION. Northern Albania.

MATERIAL EXAMINED (including 2 ♂ genitalia preparations)

Lectotype ♂, **Albania**: 15 km NNE. of Kula e Lumës, Bështriq ('Pashtriq'), 1896 m, 29.v.–4.vi.1918 (*Penther, Predota & Zerny*) (genitalia slide no. 1491; NM).

Albania: 1 ♂ (paralectotype), same data as lectotype (NM).

Mirificarma interuptella (Hübner)

(Figs 1, 2, 4, 23, 50, 77, 84, 99, 111)

Ph[alaena] Tin[ea] interuptella Hübner, 1793: 14, pl. 88. Type(s) [not traced].
Tinea interruptella Hübner; Hübner, 1822: 72. [Incorrect subsequent spelling of *interuptella* Hübner.]
Anacampsis interrupta Curtis, 1827: no. 189, folio [2]. [Unjustified emendation of *interuptella* Hübner.]

♂, ♀, 7·0–8·5 mm. Head white to cream. Labial palpus with dark apex; second segment with brown areas, particularly externolaterally, sometimes dark, apex cream. Thorax white to cream, occasionally with thin, median, longitudinal dark brown stripe. Tegula dark brown, sometimes with scattered cream scales. Fore wing (Fig. 23) cream tinged with pale yellow; with scattered brown scales. Dark brown, median, longitudinal band present, continuous but usually darker in fold and on costal edge of band from one-third to apex. Fore wing apex distinctly edged with small dark brown spots.

GENITALIA ♂ (Figs 50, 77). Uncus small, half to two-thirds width of tegumen; sometimes slightly constricted at base. Gnathos a large strongly-angled hook, without median spine. Actual margin of tegumen slightly less emarginate than sclerotized margin anteriorly. Sacculus long, slender with spatulate apex. Filament helical, very moderately stout; not extending posteriorly far beyond hind edge of vinculum, scarcely extending beyond tegumen anteriorly. Hind edge of vinculum far-projecting, narrowing to median V-shaped emargination. Vinculum with single sclerite. Saccus very slender, slightly deflected to left in ventral view, extending slightly beyond tegumen anteriorly. Aedeagus slightly longer than tegumen plus uncus; apex cylindrical with tiny projection.

GENITALIA ♀ (Figs 99, 111). Posterior margin of seventh abdominal segment with area of well-defined sclerotization on tergite and pair of adjoining patches on sternite. Very slight, flimsy invagination of membrane between eighth sternite and papillae anales. Eighth sternite strongly sclerotized laterally; asymmetrical, with lobe projecting over median area from left side in ventral view; lateral areas distinctly contrasting with membraneous median area. Median area of sternite without striations. Tergite consisting of lateral longitudinal strips connected by narrow posterior horizontal strip, all strongly sclerotized; otherwise absent. Apophyses anteriores diverging lobes, length approximately 0·3–0·4 mm (8), left shorter than right in ventral view; apophysis posterior approximately three to four times length of apophysis anterior. Antrum almost straight, sometimes deflected to one side, narrowing towards anterior; anterior not indented; moderately long, extending beyond apophyses anteriores. Ductus bursae of similar length to oval or round corpus bursae. Signum oval, curved inwards, covered with tiny spinules.

Remarks. The small dark spots at the apex of the fore wing are also present in many other species; as the spots contrast with the light ground colour of the wing in *interuptella*, they are particularly pronounced. The frenulum in five females examined consists of three setae. The genitalia are more asymmetrical than those of other *Mirificarma* species, particularly the male saccus and the eighth sternite and apophyses anteriores of the female.

This species bears a superficial resemblance to *fasciata* and to specimens of *mulinella* in which the fore wing ground colour is pale and the stripe is unbroken, although the dark fore wing stripe of *interuptella* contrasts more strongly with the cream ground colour. *M. interuptella* is clearly distinguished from both species by the form of the male filament, the slender sacculus with a spatulate apex which is unique within the genus, and the apophysis anterior of the female.

M. interuptella appears to have some affinities to *burdonella* and *flavonigrella*, with which it shares the aedeagus apex shape; in the female, the lobe-shaped apophysis anterior and the degree of sclerotization of the eighth sternite resemble those of *burdonella*. *M. interuptella* is distinguished from both species by characters including the sacculus shape and the large gnathos, and from *burdonella* by the presence of the signum. The female of *flavonigrella* is unknown.

Subsequent to Hübner's original description, many authors have misspelt *interuptella* as '*interruptella*' including Koçak (1982: 106) who incorrectly cites '*interruptella* Hübner, 1793' as a junior primary homonym of *interruptella* de Villers (1789: 520) and proposes *albicosta* Haworth as the replacement name. *Coleophora albicosta* Haworth is currently a valid species of Coleophoridae (Bradley, 1966: 132). The identity of *Phalaena (Tinea) interruptella* de Villers is unknown.

Biology. Host-plants: Genisteae: *Cytisus scoparius* (L.) Link (as *Spartium scoparium*) (Disqué, 1908: 129); *C. purgans* (L.) Boissier, formerly in *Genista* (Lhomme, [1946–1948]: 594); *Genista* (*tinctoria* L., *pilosa* L., *germanica* L., or *sagittalis* L.) (Disqué, 1908: 79).

The larva probably lives in the flowers (Lhomme, [1946–1948]: 594, attributes this information to Peyerimhoff) although Schütze (1931: 121) records it in August under leaves spun to the twig (on *C. scoparius*). Sorhagen (1886: 187) records the larva in May. Moths have been collected from March to July (also in August according to Sorhagen, 1886: 187).

Distribution. Spain, France, central Europe, Czechoslovakia, Poland, North Africa.

Additional records. Portugal (Zerkowitz, 1946: 133); Belgium (Lhomme, [1946–1948]: 594); Netherlands (Lempke, 1976: 26); Italy (Mariani, 1943: 167). Records of *interuptella* from Great Britain are misidentifications of *mulinella* (see p. 43).

Material examined (including 11 ♂, 10 ♀ genitalia preparations)

Spain: 1 ♂, Avila (NM); 1 ♂, 1 ♀, Teruel (NM); v–vii; 1 ♂, 1 ♀, Granada (NM). **France**: 2 ♂, 1 ♀, Essonne; 1 ♂, Lot; 2 ♀, Pyrénées-Orientales; 2 ♂, 1 ♀, Basses Alpes; 6 ♂, 11 ♀, Var; iv–vi. **Germany**: 1 ♂, 2 ♀, —; 1 ♂, N. **Germany (West)**: 1 ex., Baden-Württemberg; 1 ♀, Niedersachsen, v (coll. Jäckh, Bidingen); 1 ♂, Hamburg, vi (coll. Jäckh, Bidingen). **Germany (East)**: 1 ♀, Potsdam, vii (NM). **Switzerland**: 1 ♂ (NM). **Austria**: 1 ♂, 1 ♀, Wien (NM). **Czechoslovakia**: 1 ♀, Plzeň, v ? (NM). **Poland**: 5 ♂, 5 ♀, Szczecin; 1 ♂, Zielona Góra; v, vi ? **Morocco**: 2 ♂, iii. **Algeria**: 1 ♂, 1 ♀, Constantine province, v ? **Tunisia**: 1 ♂, iv. No locality data: 33 ex.

Mirificarma flavonigrella (Chrétien) comb. n.

(Figs 1, 2, 24, 51, 59, 78)

Gelechia flavonigrella Chrétien, 1915: 318. LECTOTYPE ♂, Algeria (MNHN), here designated [examined].

♂, 6·0 mm. Head cream. Labial palpus cream, mottled with dark brown mostly confined to outer surface of first and second segments. Thorax cream; tegula dark brown. Fore wing (Fig. 24) mottled light brown and cream, darker in apical fifth; costal margin brown, dark at base; with dark brown stripe along fold separated by pale area from longitudinal, median, more diffuse brown stripe which extends from half to near apex. Faint yellowish tinge scattered on fore wing.

GENITALIA ♂ (Figs 51, 59, 78). Uncus small, narrowing towards apex, approximately half width of tegumen. Gnathos a small simple hook. Actual margin of tegumen coincides with sclerotized margin anteriorly. Sacculus long, extending far beyond median projection of hind edge of vinculum; broad apically, club-shaped, with inner edge slightly rugose towards apex. Filament curved although apical half almost straight; basal half expanded dorsoventrally and compressed laterally, smooth; apical half moderately, uniformly, slender. Filament not reaching hind edge of vinculum posteriorly, extending beyond tegumen anteriorly. Median projection of hind edge of vinculum with shallow V-shaped emargination. Vinculum with pair of sclerites converging near hind edge of vinculum. Saccus moderately broad, parallel-sided with rounded apex, barely extending beyond tegumen. Aedeagus slightly longer than tegumen plus uncus; apex almost cylindrical with minute projection.

GENITALIA ♀. Unknown.

REMARKS. This species bears a very close superficial resemblance to some *mulinella* specimens in which the fore wing has a light background and a broken stripe, but it can be distinguished from *mulinella* by the club-shaped sacculus of the male genitalia. *M. flavonigrella* is very similar to *burdonella* in external appearance and genitalia, and might prove to be no more than a subspecies if further material becomes available. They are allopatric but this may not be significant as both species are known from so little material. *M. flavonigrella* differs from *burdonella* in the fore wing pattern since the two stripes are slightly less widely separated by a pale area. The male genitalia differ from those of *burdonella*, mainly in the sacculus extending far beyond the median projection of the hind edge of the vinculum, and in the shallower emargination of this projection.

M. flavonigrella was described from an unspecified number of specimens of which I designate as lectotype the single type-specimen examined, which was already labelled 'lectotype' by Sattler.

BIOLOGY. Host-plant unknown. The moth has been found in May.

DISTRIBUTION. Algeria (Oran area).

MATERIAL EXAMINED (including 1 ♂ genitalia preparation)

Lectotype ♂, **Algeria**: near Oran, Frenda, v.1911 (genitalia slide no. 471b, Sattler; MNHN).

Mirificarma burdonella (Rebel)

(Figs 1, 2, 25, 52, 79, 100, 112)

Gelechia burdonella Rebel, 1930: 25. LECTOTYPE ♂, CORSICA (NM), here designated [examined].
Gelechia bardonella Rebel; Gaede, 1937: 148. [Incorrect subsequent spelling.]

♂, 5·5–6·5 mm. ♀, 5·5–6·0 mm. Head cream to light brown. Labial palpus cream, mottled with dark brown mostly confined to outer surface of first segment and basal part of second segment; apex dark brown. Thorax cream to light brown, sometimes with scattered brown scales. Tegula usually brown in basal half, pale apically. Fore wing (Fig. 25) mottled light brown and cream, usually darker in apical fifth and at costal margin, with irregular dark brown stripe along fold. This stripe usually well separated by pale area from longitudinal, irregular, dark brown stripe which is median or slightly costad, extending from almost half to three-quarters or near apex, continuous, or, infrequently, broken. Faint longitudinal yellowish streak sometimes present in costal half and fold line.

GENITALIA ♂ (Figs 52, 79). Uncus small, narrowing towards apex, slightly more than half to two-thirds tegumen width. Gnathos a small simple hook. Actual margin of tegumen almost coincides with sclerotized margin anteriorly. Sacculus scarcely extending beyond median projection of hind edge of vinculum; broad, club-shaped, with inner edge slightly rugose. Filament slightly curved although apical half almost straight; basal half expanded dorsoventrally, laterally compressed and wrinkled; apical half moderately, uniformly, slender. Filament not reaching hind edge of vinculum posteriorly, extending a short distance beyond tegumen anteriorly. Median projection of hind edge of vinculum with deep, narrow U- or V-shaped emargination. Vinculum with pair of sclerites converging near hind edge of vinculum. Saccus moderately broad, parallel-sided or narrowing slightly towards rounded apex, extending slightly beyond tegumen anteriorly. Aedeagus slightly longer than tegumen plus uncus, slightly S-shaped; apex almost cylindrical with tiny projection.

GENITALIA ♀ (Figs 100, 112). Posterior margin of seventh abdominal segment with area of well-defined sclerotization on tergite, pair of patches sometimes present on sternite. Invagination of membrane between eighth tergite and papillae anales long and narrow. Eighth sternite strongly sclerotized laterally, wrinkled, distinctly contrasting with weakly sclerotized, horizontally striated median area bordered by pair of narrow longitudinal sclerites. Tergite with pair of very small, lateral, sclerotized areas extending from sternite, otherwise weakly sclerotized. Apophyses anteriores diverging lobes, length 0·2 mm (3); apophysis posterior approximately six times length of apophysis anterior. Antrum slightly curved and constricted towards anterior; anterior not indented; moderately long, approximately two to three times length of apophysis anterior. Ductus bursae at most one-third length of oval corpus bursae. Signum not discernible.

REMARKS. The frenulum of two out of the three females examined consists of three setae; in the remaining female it consists of three setae on one wing and two on the other.

Externally this species strongly resembles *flavonigrella* and some specimens of *mulinella* in which the fore wing pattern has a pale background and a broken stripe, although in *burdonella* the two stripes are slightly more widely separated. *M. burdonella* is clearly distinguished from *mulinella* by the club-shaped sacculus, the lobe-shaped apophysis anterior and the degree of sclerotization of the female eighth sternite. *M. burdonella* appears to be most closely related to *flavonigrella* from which it can be distinguished by the extent of the sacculus.

M. burdonella was described from an unspecified number of syntypes from Corsica: Col de Vergio and Evisa. I have examined 2 ♂ syntypes from Col de Vergio and 1 ♀ syntype from Evisa and I designate a male as lectotype. All three specimens bear the label 'Type'.

BIOLOGY. Host-plant unknown. Moths have been found in August and September.

DISTRIBUTION. Corsica and Sardinia.

MATERIAL EXAMINED (including 6 ♂, 3 ♀ genitalia preparations)

Lectotype ♂, **Corsica**: Col de Vergio, 1460 m, at light ('Lichtfang'), 31.viii.1929 (*Reisser*) (genitalia slide no. 11227; NM).

Corsica: 1 ♂ (paralectotype), Col de Vergio, 1460 m, 3.ix.1929 (*Reisser*) (NM); 3 ♂, 3 ♀, Col de Vergio, 1450, 1460 m, viii, ix (BMNH; NM); 1 ♀ (paralectotype), Evisa, 850 m, 4.ix.1929 (*Reisser*) (NM); 1 ♀, Col de Sevi, 1000 m, ix. **Sardinia**: 1 ♂, centr[al], valley ? ('vl.') Bruncu Spina, 1750 m, viii; 1 ♂, S. ('merid.'), 'Musei', 120 m, ix.

Mirificarma cabezella (Chrétien)

(Figs 1, 2, 26, 53, 54, 80, 101)

Gelechia maculatella f. *cabezella* Chrétien, 1925: 245. Lectotype ♂, SPAIN (MNHN), designated by Sattler (1961: 86) [examined].

Mirificarma cabezella (Chrétien) Sattler, 1960: 42; Agenjo, 1962: 159, pl. 2, fig. 7, pl. 3, fig. 8 [legends to figs 7 and 8 are transposed on pl. 3].

♂, 6·5–7·5 mm. ♀, 6·5–7·0 mm. Head mid brown, occasionally ochreous brown. Labial palpus mottled dark brown and cream, usually predominantly cream on inner surface. Thorax and tegula as head. Fore wing (Fig. 26) mottled brown, darker in apical half; small area of dark brown at base; ochreous tinge near base. Faint cream spot at costa at three-quarters extending diffusely to dorsal margin, usually crossed medially by faint longitudinal ochreous dash. Dark brown spot across fold at one-third, extending diffusely to dorsal margin; another at end of cell, usually constricted or bisected, frequently merging with dark background. Both spots sometimes diffuse; with narrow ochreous surround. Very small, indistinct dark brown spot in fold near base.

GENITALIA ♂ (Figs 53, 54, 80). Uncus small, nearly half width of tegumen; scarcely constricted at base; apex without projection. Gnathos a moderately large, distinctly curved, simple hook. Actual margin of tegumen slightly less emarginate than sclerotized margin anteriorly. Sacculus very long, extending beyond gnathos arms, almost straight, uniformly moderately slender, smooth. Filament almost straight, very slender; extending posteriorly approximately to hind edge of vinculum; extending a short distance beyond tegumen anteriorly. Median projection of hind edge of vinculum low with indistinct dorsal V-shaped emargination; very slight median ventral emargination. Vinculum with slightly bowed pair of sclerites from saccus. Saccus usually slightly narrower towards truncate or irregular apex, extending slightly beyond tegumen anteriorly. Aedeagus same length as tegumen plus uncus; projection near apex moderately large, weakly sclerotized, rounded.

Genitalia ♀ (Fig. 101). Posterior margin of seventh abdominal segment without sclerotized area but with distinct dense band of scales. Invagination of membrane between eighth tergite and papillae anales funnel-shaped. Most of eighth segment sclerotized. Median longitudinal areas of sternite and tergite slightly less sclerotized than surrounding areas, slightly sunken. Tergite median longitudinal area bordered by pair of faint, narrow sclerites. Apophysis anterior rod-like, with separate, large, rounded lobe at base towards antrum; length 0·3–0·4 mm (4); apophysis posterior three to four times length of apophysis anterior. Antrum slightly curved and constricted towards anterior; anterior not indented; moderately long, longer than but less than 1·5 times length of apophysis anterior. Posterior half of antrum less sclerotized than anterior half. Ductus bursae not more than half length of oval corpus bursae. Signum not discernible.

Remarks. The female frenulum consists of three setae. The band of scales at the posterior margin of the female abdomen, distinct in this species and in *ulicinella* and *mulinella*, is also present, although more diffuse, in some other species. The weaker sclerotization of the posterior half of the antrum is distinct in *cabezella*, although it also occurs, less noticeably, in other species including *mulinella, ulicinella* and *burdonella*.

The Moroccan male differs slightly in genitalia from Spanish males. The filament is slightly shorter, particularly the part apical to the tiny opening near the apex, and the saccus is almost parallel-sided, whereas it narrows slightly, towards the apex, in the Spanish specimens.

This species bears a superficial resemblance to *rhodoptera, scissella* and, particularly, to *constricta*. It differs from *rhodoptera* and *scissella* in many genitalic characters since these two species are in the *maculatella*-group, and from *constricta* in the shape of the uncus, sacculus and filament. *M. cabezella* appears to be closely related to *mulinella* and *ulicinella*. They share the uniformly slender, straight sacculus of the male, and the distinct, dense band of scales of the posterior margin of the female abdomen. *M. cabezella* differs in wing pattern and by the very slender filament of the male genitalia and the presence of the lobe at the base of the apophysis anterior of the female.

Biology. Host-plant: Genisteae: *Adenocarpus hispanicus* (Lamarck) (type-series bred by Chrétien).

Chrétien (1925: 245) found the larvae in the shoots in June; the moths emerged in September. Moths have been collected in August and October.

Distribution. Spain and Morocco.

Material examined (including 4 ♂, 4 ♀ genitalia preparations)

Lectotype ♂, **Spain**: [Segovia,] La Granja ('San Ildefonso'), larva on *Adenocarpus hispanicus*, vi.1902, ex. ix. 1902 (*Chrétien & Dumont*) (genitalia slide no. 3562, Viette; MNHN).

Spain: 3 ♂, 2 ♀ (paralectotypes), data as lectotype, ex viii, ix.1902 (*Chrétien & Dumont*) (MNHN; LN); 1 ♀, —, viii (MNHN). **Morocco**: 1 ♂ 1 ♀, Moyen Atlas, Val d'Ifrane, 1500–1600 m, x (coll. Burmann, Innsbruck).

Mirificarma ulicinella (Staudinger)

(Figs 1, 2, 27, 55, 81, 102)

Gelechia ulicinella Staudinger, 1859: 240; Millière, 1863: 325, pl. 38, figs 8–10. LECTOTYPE ♂, Spain (MNHU), here designated [examined].

♂, 5·5–6·5 mm. ♀, (4·5) 5·0–6·0 mm. Head ochreous cream. Labial palpus cream mottled with brown on outer surface, usually predominantly brown towards base; predominantly cream on inner surface; apex brown. Thorax and tegula ochreous cream slightly mottled with brown; tegula usually very dark brown at base. Fore wing (Fig. 27) mottled dark and light brown; with paler yellow-ochre areas situated as follows: dorsal margin at base; along fold; median longitudinal stripe from one-third to three-quarters or near apex, adjoining fold, irregular, constricted or broken, crossed by indistinct transverse stripe or blotch at two-thirds or nearer apex; longitudinal stripe near costa from base to one-third. Two small dark brown spots on median stripe at one-third and one-half, sometimes indistinct.

Genitalia ♂ (Figs 55, 81). Uncus small, less than one-third to less than half-width of tegumen; scarcely constricted at base; apex with tiny, pointed, median projection. Gnathos short, only slightly curved, extreme apex a small hook-shape. Actual margin of tegumen coincides with sclerotized margin anteriorly. Sacculus not reaching gnathos arms, straight, uniformly very slender, smooth. Filament curved, not spiralled; extremely stout basally, laterally compressed and dorsoventrally expanded in apical half, narrowing towards apex; extending posteriorly almost to hind edge of vinculum or slightly beyond; not usually reaching anterior of tegumen. Median projection of hind edge of vinculum with heart-shaped dorsal emargination, not emarginate ventrally. Vinculum with strongly bowed pair of sclerites from saccus. Saccus broad at base, narrowing towards truncate apex; reaching anterior of tegumen. Aedeagus same length as tegumen plus uncus or slightly shorter; projection near apex moderately large, weakly sclerotized, rounded.

Genitalia ♀ (Fig. 102). Posterior margin of seventh abdominal segment without sclerotized area but with distinct dense band of scales. Invagination of membrane between eighth tergite and papillae anales broad, almost truncate. Most of eighth segment sclerotized; median longitudinal areas of sternite and tergite slightly less sclerotized than surrounding areas. Tergite strongly sclerotized, with pair of gently curved lobes overlapping narrow median longitudinal area. Apophysis anterior rod-like, enlarged at base towards antrum, but without separate lobe; length 0·3–0·4 mm (5); apophysis posterior three times length of apophysis anterior. Antrum slightly curved and constricted towards anterior; anterior not indented; moderately long, approximately 1·5 times length of apophysis anterior. Ductus bursae considerably shorter than oval corpus bursae. Signum not discernible.

Remarks. The frenulum was examined in five females and consists of two setae. This species appears to be closely related to *mulinella* and *cabezella* with which it shares genitalic characters including the sacculus shape and the distinct band of scales at the posterior margin of the female abdomen. It differs in its slightly curved gnathos and shorter sacculus of the male and in the form of the eighth tergite of the female. The fore wing of *ulicinella*, with yellow-ochre areas not in a transverse zig-zag pattern, differs from all other *Mirificarma* species.

M. ulicinella was described from four specimens from Spain: Granada. I have examined 1 ♂, 1 ♀ and designate as lectotype the male which was already labelled 'lectotype' by Sattler.

Biology. Host-plant: Genisteae: *Ulex parviflorus* Pourret (= *australis* Clemente; = *provincialis* Loisel) (type-series bred by Staudinger).

The larva has been recorded from October to April in the flowers; it pupates at the base of the plant in a shell of dried leaves, the adult emerging in August; there is only one generation per year (Millière, 1863: 326; Lhomme, [1946–1948]: 566, Staudinger, 1859: 241). Moths have been collected at light and bred in September (also in May and June according to Lhomme, [1946–1948]: 566).

Distribution. Spain and France.

Additional record. Italy: Liguria (Mariani, 1943: 166).

Material examined (including 7 ♂, 5 ♀ genitalia preparations)

Lectotype ♂, **Spain**: Granada, iv, larva on *Ulex australis*, moth emerged ix (*Staudinger*) (genitalia slide no. 476d, Sattler; MNHU).

Spain: 1 ♀ (paralectotype), same data as lectotype (MNHU); 23 ♂, 7 ♀, Granada province, Sierra de Alfacar, 1500 m, ix. **France**: 1 ♂, Provence. No locality data: 1 ♂.

Mirificarma mulinella (Zeller)

(Figs 1, 2, 28–30, 56, 82, 103)

Gelechia mulinella Zeller, 1839: 199; Stainton, 1865: 96, pl. 3, fig. 3. LECTOTYPE ♀, Germany (East) (BMNH), here designated [examined].

[*Anacampsis interrupta* Curtis, 1827: no. 189, folio [2]. Unjustified emendation of *interuptella* Hübner. Misidentification.]

[*Anacampsis interruptella* (Hübner) ?; Stephens, 1829: 197; Curtis, 1829 [–1831]: [91]. Incorrect subsequent spelling of *interuptella* Hübner. Misidentifications.]

[*Anacampsis interruptella* (Hübner); Stephens, 1834: 215; Westwood, 1845: 191, pl. 107, fig. 3. Incorrect subsequent spelling of *interuptella* Hübner. Misidentifications.]

Gelechia caminariella Fuchs, 1902: 323. Holotype ♀. Germany (West): [Rheinland-Pfalz,] Rheingau, near Bornich, Rheinberge, Rieslingberg, around *Sarothamnus*, viii. 1878 (*Fuchs*) [not traced]. [Synonymized by Rebel, 1930: 25.]

Gelechia carminariella Fuchs; Eckstein, 1933: 134. [Incorrect subsequent spelling of *caminariella* Fuchs.]

Gelechia nigraesilvae Amsel, 1950: 27, figs 1, 2. Holotype ♂, GERMANY (WEST) (LN) [examined]. [Synonymized by Karsholt & Nielsen, 1976: 33.].

♂, 6·0–7·5 mm. ♀ (4·5) 5·5–7·5 mm. Head cream to light brown. Labial palpus mottled brown and cream; apex dark brown; apex second segment usually mostly cream. Thorax and tegula light to mid brown often mottled with dark brown. Tegula slightly darker brown towards base. Fore wing (Figs 28–30) mottled brown, mixed with cream or light brown in apical third and occasionally also in posterior third. Dark brown spot usually present, at end of cell. Small dark brown spots sometimes present, at one-third, one in fold, one in cell. Dark brown, median, longitudinal stripe sometimes present, from one-third to apex, another in fold line. These stripes merge to form single diffuse band, or slightly separated by pale area.

GENITALIA ♂ (Figs 56, 82). Uncus small, half to almost two-thirds width of tegumen; scarcely constricted at base; apex without projection. Gnathos a moderately large, distinctly curved, simple hook; extreme apex usually a very slight hook-shape. Actual margin of tegumen coincides with sclerotized margin anteriorly. Sacculus long, reaching or extending beyond gnathos arms, straight, uniformly very slender, smooth. Filament straight or gently curved, not spiralled; stout, particularly basally, laterally compressed in apical half; not reaching hind edge of vinculum posteriorly, extending a short distance beyond tegumen anteriorly. Median projection of hind edge of vinculum high with shallow, ventral U- or V-shaped emargination. Vinculum with pair of sclerites slightly bowed or diverging from saccus. Saccus slender, almost parallel-sided with rounded or irregularly truncate apex; extending moderately well beyond tegumen anteriorly. Aedeagus slightly longer than tegumen plus uncus; projection near apex moderately large, weakly sclerotized, rounded.

GENITALIA ♀ (Fig. 103). Posterior margin of seventh abdominal segment without sclerotized area but with distinct dense band of scales. Invagination of membrane between eighth tergite and papillae anales small, broadly conical or funnel-shaped. Most of eighth segment sclerotized; median longitudinal areas of sternite and tergite slightly less sclerotized than surrounding areas; median longitudinal area of sternite slightly sunken. Tergite without pair of curved lobes. Apophysis anterior rod-like, without separate lobe at base towards antrum, slightly constricted near apex; length 0·3–0·5 mm (9); apophysis posterior three to four times length of apophysis anterior. Antrum slightly curved and constricted towards anterior; anterior not indented; moderately long, usually 1·5 times to twice length of apophysis anterior. Ductus bursae usually one-quarter to less than half length of oval or round corpus bursae. Signum not discernible.

REMARKS. The frenulum of *mulinella* consists of two setae, or two setae on one wing and three on the other. In the male genitalia, the filament basal half varies in stoutness. The fore wing pattern of this species varies by degrees from almost uniform to a pale background contrasting with a dark broken or unbroken stripe. The contrasted form tends to occur particularly in southern France and southern England. The specimens with an unbroken stripe bear a strong superficial resemblance to *interuptella* although the contrast of pale and dark areas is never as great in *mulinella* as it is in *interuptella*. Specimens with a broken stripe on a pale background sometimes closely resemble *flavonigrella* and *burdonella*, although the more apical stripe is slightly longer than in *burdonella*.

M. mulinella can be distinguished from these by its uniformly slender sacculus and its rod-like apophysis anterior. It appears to be closely related to *ulicinella* and *cabezella*, since the genitalia are similar, although the fore wing pattern differs. The male genitalia differ from those of *ulicinella* in the shape of the gnathos, and from *cabezella* in the shape of the filament and the median projection of the hind edge of the vinculum. In the female genitalia, *mulinella* can be distinguished from *ulicinella* by the form of the eighth tergite and from *cabezella* by the absence of lobes at the base of the apophysis anterior.

M. mulinella was described from 2 ♂, 4 ♀ from East Germany: Dresden and Poland: Glogów ('Glogau'). I designate as lectotype the single type-specimen examined, from Dresden, which was already labelled 'lectotype' by Sattler.

BIOLOGY. Host-plants: Genisteae: *Ulex europaeus* L. (Stainton, 1865: 228); *Cytisus scoparius* (L.) Link (formerly in *Sarothamnus*) (specimens bred by Pitkin and Sattler, England; Stainton, 1865: 228); *C. nigricans* L. (Hartig, 1964: 27); *Genista germanica* L. (Sorhagen, 1886: 187); *Calicotome spinosa* (L.) Link (Lhomme, [1946–1948]: 593).

In Great Britain, the only published host-plant records for *mulinella* are *Ulex* and *C. scoparius*; however, I have seen specimens bred by Agassiz from a cultivar of *Genista tinctoria* L. This plant is the host of the only other species of *Mirificarma* in Great Britain, *lentiginosella*. Specimens of *mulinella* have also been bred by Langmaid (pers. comm.) from *Lupinus arboreus* Sims in Great Britain (Hampshire).

Outside Great Britain, *Spartium* has been recorded as a host-plant by Mariani (1943: 167); however, this should probably be referred to *C. scoparius*, known as *Spartium scoparium* by some authors including Stainton (1867: 26). A record of *Bartsia aspera* (Brotero) Lange (Scrophulariaceae) (Zerkowitz, 1946: 133) as a host-plant of *mulinella* is very dubious.

The larva occurs from April to early May; on *Ulex* and *C. scoparius* it makes a small hole in a bud that is not fully open and feeds on the interior of the flower, before repeating the process in another flower. It pupates on the ground in a slight cocoon amongst leaves (Stainton, 1865: 96). The larva is found on the leaves instead of the flowers on *L. arboreus*, which, unlike *Ulex* and *C. scoparius*, does not have reduced leaves (Langmaid, pers. comm.).

The larva is also found in June (Sorhagen, 1886: 187). The pupal stage is in May and June (Bradford, [1979]: 123). Moths have been collected from July to November, also in February in North Africa.

DISTRIBUTION. Europe west of 20°E, north to Denmark, extending south to North Africa (Algeria, Tunisia). The published distribution extends further north, to Orkney Is. (Wolff, 1971: 161) and Norway (Opheim, 1978: 27). This widespread species is found further north than any other *Mirificarma* species.

Additional records. Portugal (Zerkowitz, 1946: 133); E. Ireland (Meyrick, 1895: 603); Channel Is.: Jersey (Sattler, pers. comm.); Belgium (Lhomme, [1946–1948]: 593); Netherlands (Lempke, 1976: 26); Sweden (Krogerus *et alii*, 1971: 21); Switzerland (Müller-Rutz, 1914: 486); U.S.S.R.: European part (Piskunov, 1981: 674).

MATERIAL EXAMINED (including 13 ♂, 11 ♀ genitalia preparations)

Lectotype ♀ (*mulinella*), **Germany (East)**: Dresden ('mis. Tischer') (genitalia slide no. 22493). Holotype ♂ (*nigraesilvae*), **Germany (West)**: Baden-Württemberg, Schwarzwald, Villengen district, Buchenberg, 22.vii.1947 (*Amsel*) (genitalia slide no. 827; LN).

Great Britain (England): 77 ex., —; 3 ex., Cheshire; 1 ♀, Salop; 2 ♂, 1 ♀, Wiltshire; 7 ♂, 3 ♀, Hampshire; 1 ♀, 3 ex., Sussex; 6 ♂, 5 ♀, London; 1 ♀, Lincolnshire; 1 ♂, Norfolk; 33 ex., Kent; vii-ix. **Channel Is.**: 1 ex., Guernsey (coll. Peet, Guernsey). **Spain**: 1 ♂, 1 ♀, Gerona, ix. **France**: 1 ♀, Basses-Pyrénées; 1 ♀, Pyrénées-Orientales; 1 ♀, Alpes-Maritimes; viii, ix ? **Denmark**: 1 ♂, NE. Jylland (ZM); 1 ♀, Sjaelland (ZM); viii. **Germany**: 1 ♂, 1 ♀, —; 3 ♂, Berlin, vi, vii. **Germany (West)**: 1 ♂, 1 ♀, Hamburg (coll. Jäckh, Bidingen); 1 ♂, Nordrhein-Westfalen (coll. Jäckh, Bidingen); 1 ♂, Hessen ?; viii. **Italy**: 2 ♂, 1 ♀, Liguria, ix (coll. Jäckh, Bidingen). **Sardinia**: 2 ♀, ix. **Sicily**: 1 ♂. **Austria**: 1 ♂ (NM). **Poland**: 1 ♀, Szczecin (NM); 1 ♂, 2 ♀, Wrocław (BMNH; NM). **Yugoslavia**: 2 ♂, 3 ♀, Dalmatia; ix–xi (NM). **Algeria**: 1 ♀, Constantine province, x. **Tunisia**: 1 ♂, 1 ♀, ii, x (NM). No locality data: 70 ex.

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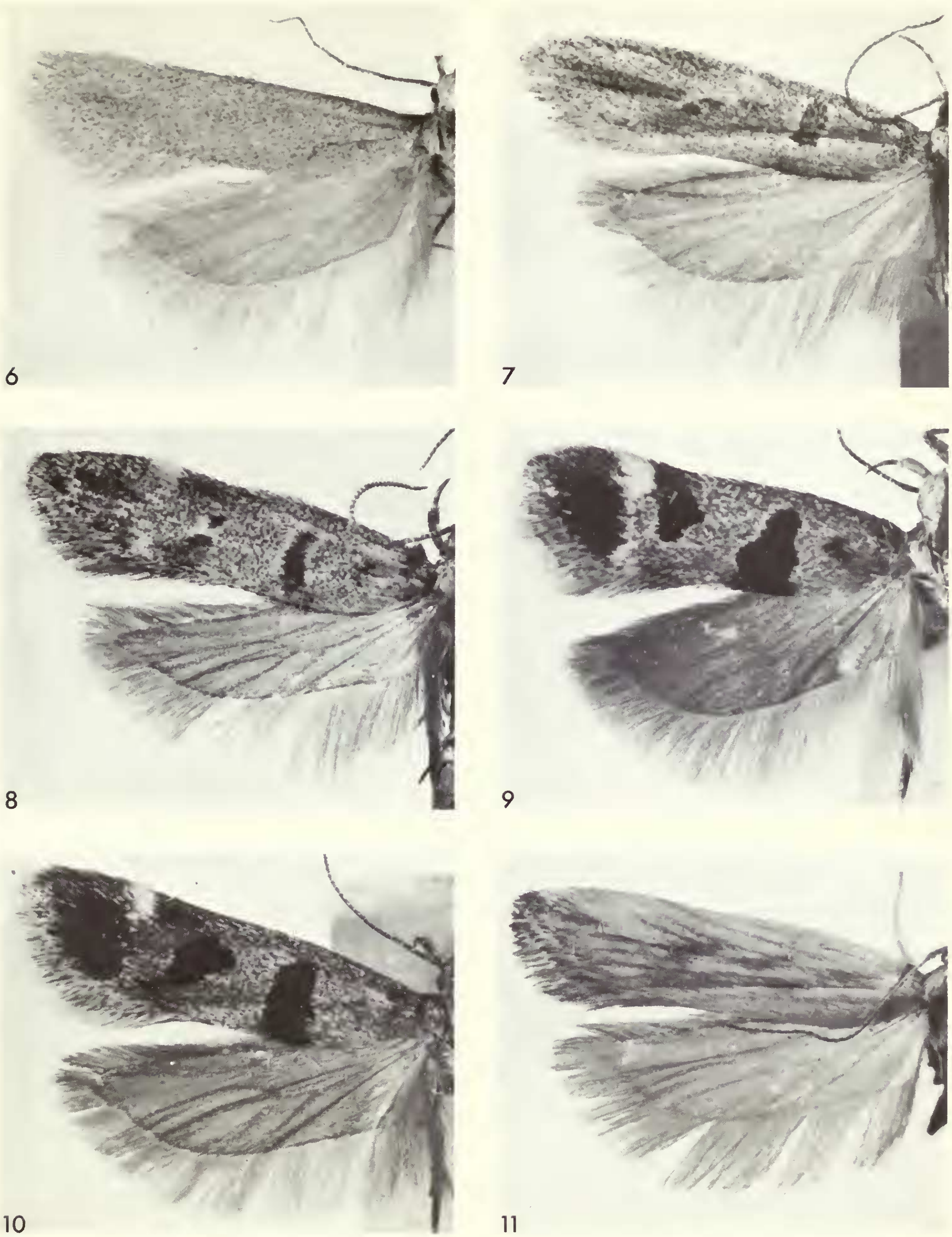
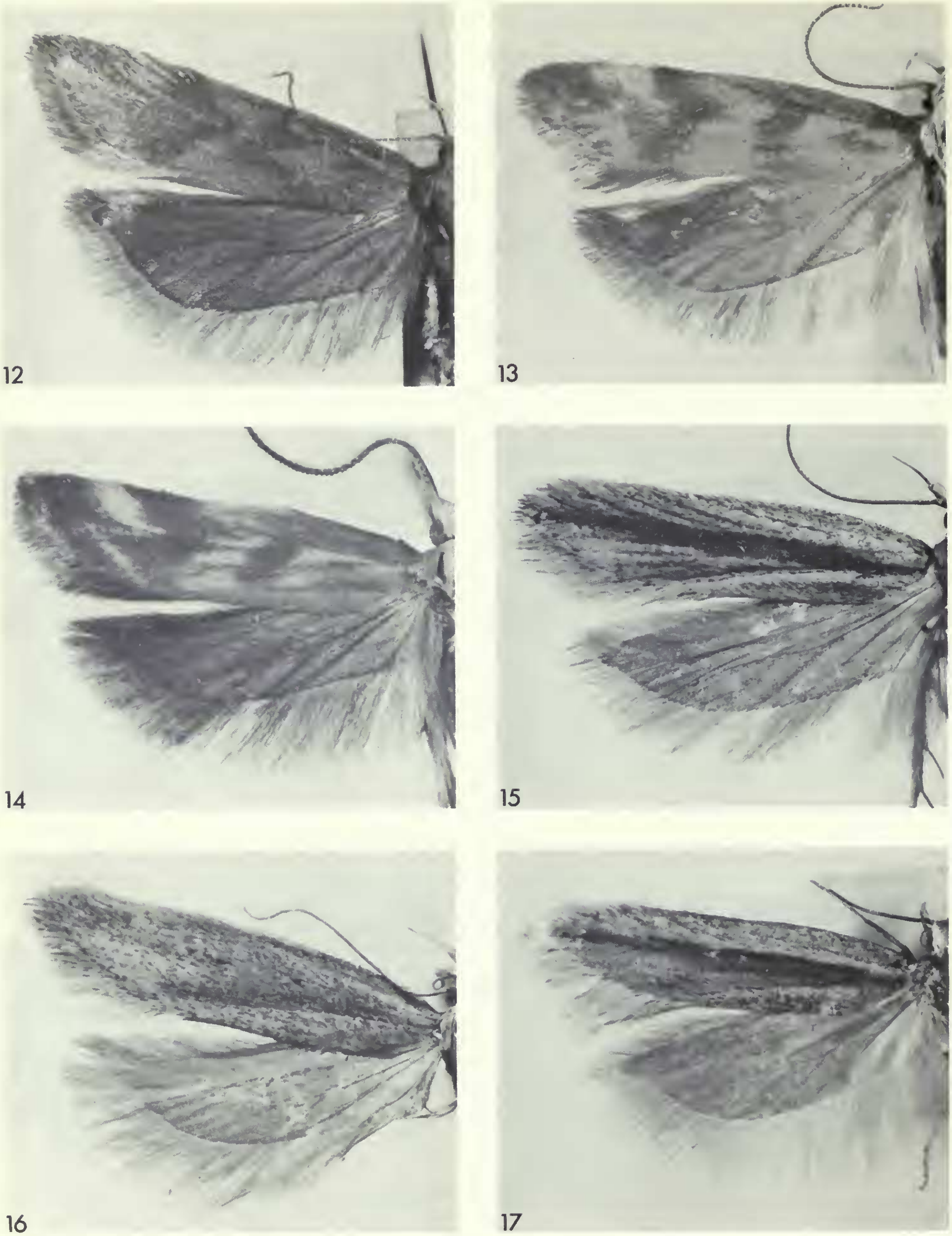
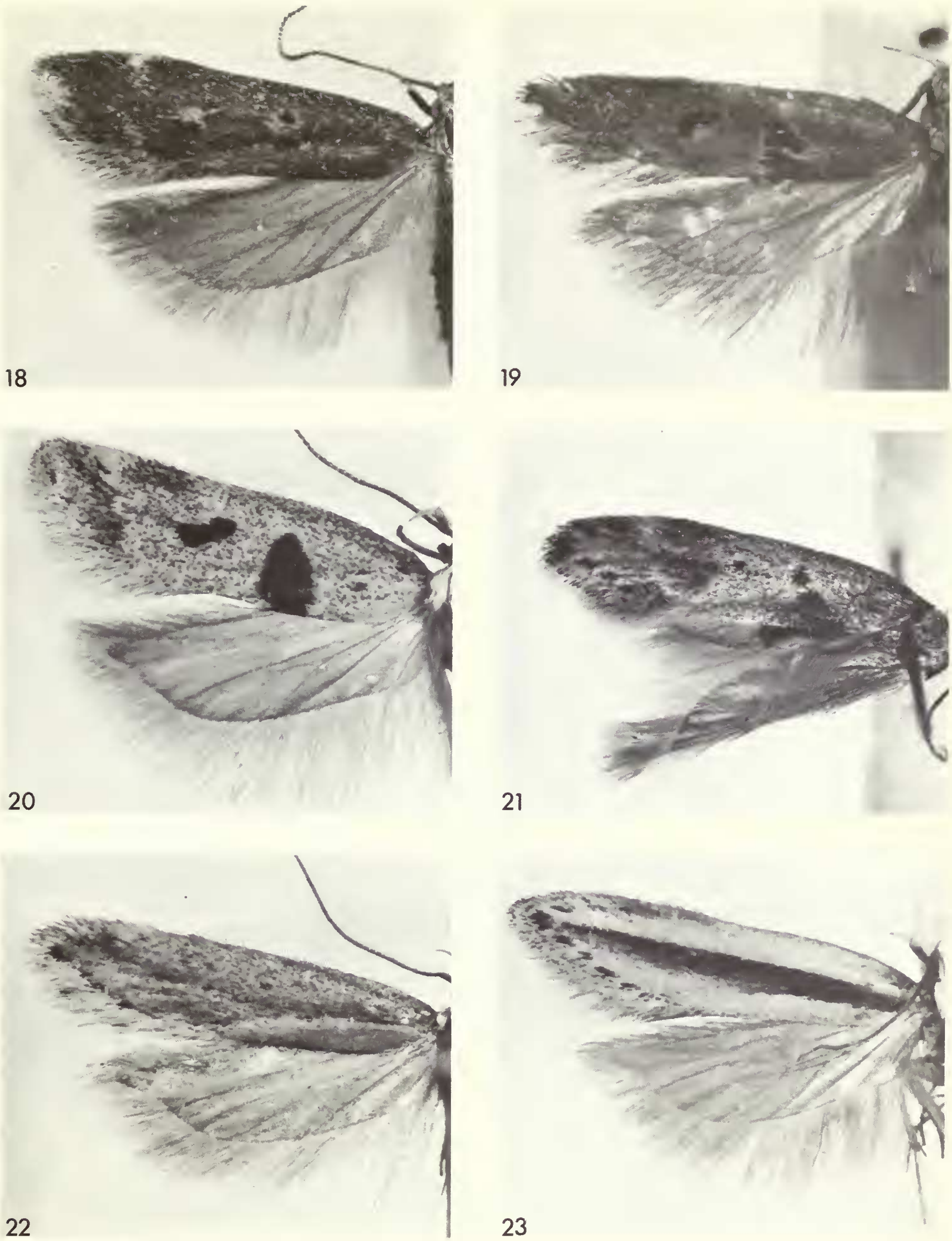


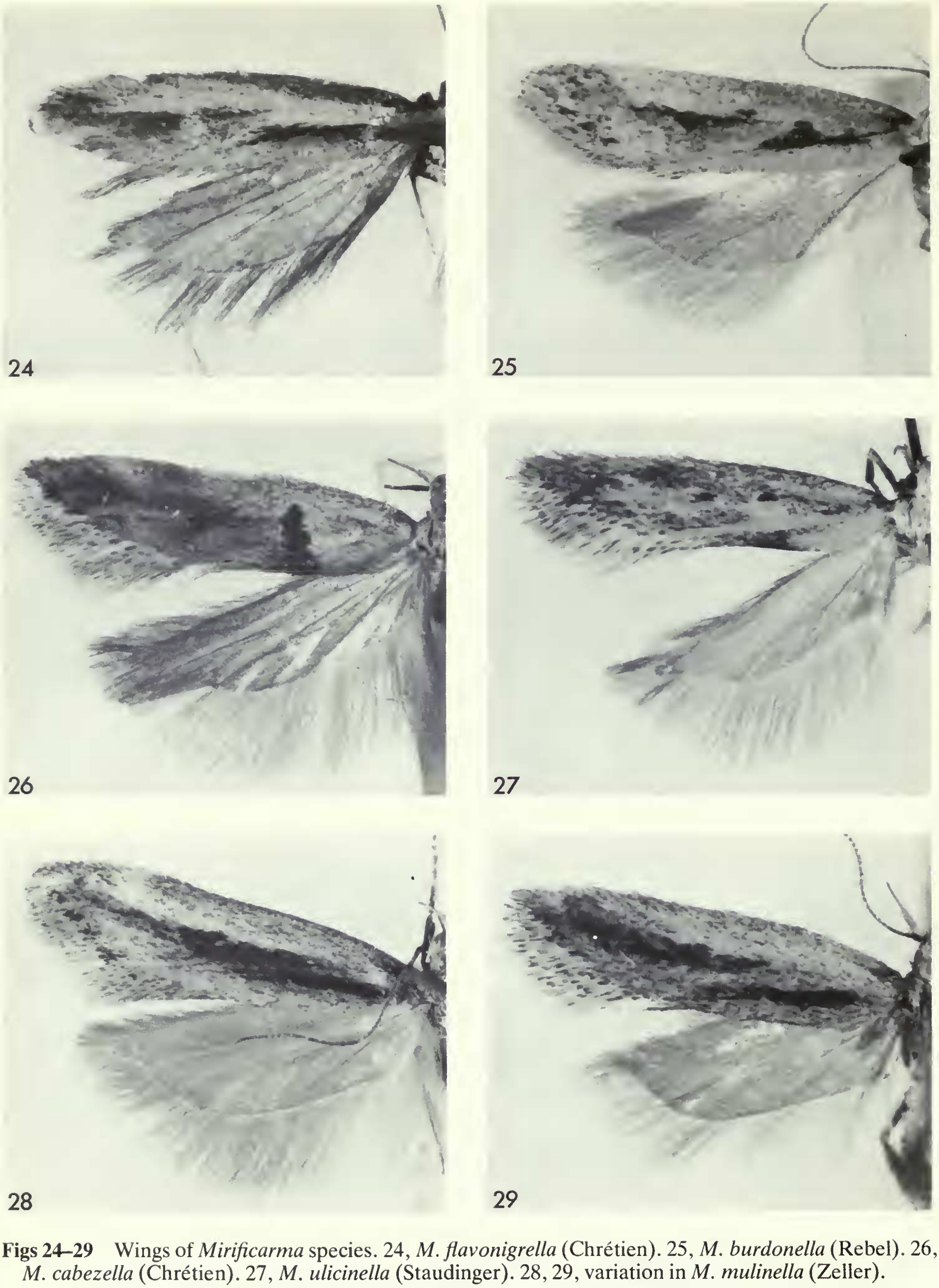
Figs 6–11 Wings of *Mirificarma* species. 6, *M. montivaga* (Walsingham). 7, *M. scissella* (Chrétien). 8, *M. rhodoptera* (Mann). 9, *M. denotata* sp. n. 10, *M. maculatella* (Hübner). 11, *M. pallidipulchra* (Walsingham).



Figs 12–17 Wings of *Mirificarma* species. 12, *M. aflavella* (Amsel). 13, *M. flavella* (Duponchel). 14, *M. eburnella* ([Denis & Schiffermüller]). 15, 16, variation in *M. ocellinella* (Chrétien). 17, *M. fasciata* sp. n.



Figs. 18–23 Wings of *Mirificarma* species. 18, *M. lentiginosella* (Zeller). 19, *M. constricta* sp. n. 20, *M. cytisella cytisella* (Treitschke). 21, *M. cytisella leonella* Amsel. 22, *M. monticolella* (Rebel). 23, *M. interuptella* (Hübner).



Figs 24–29 Wings of *Mirificarma* species. 24, *M. flavonigrella* (Chrétien). 25, *M. burdonella* (Rebel). 26, *M. cabezella* (Chrétien). 27, *M. ulicinella* (Staudinger). 28, 29, variation in *M. mulinella* (Zeller).

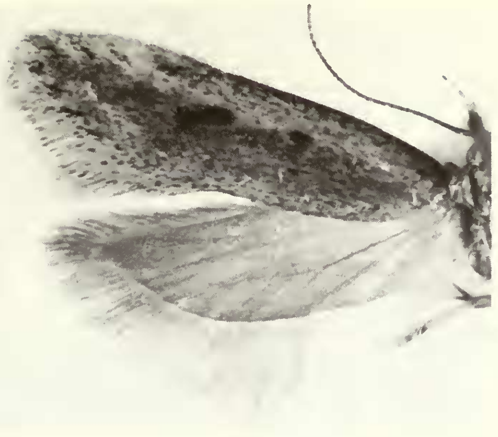


Fig. 30 Wings of *Mirificarma mulinella* (Zeller).

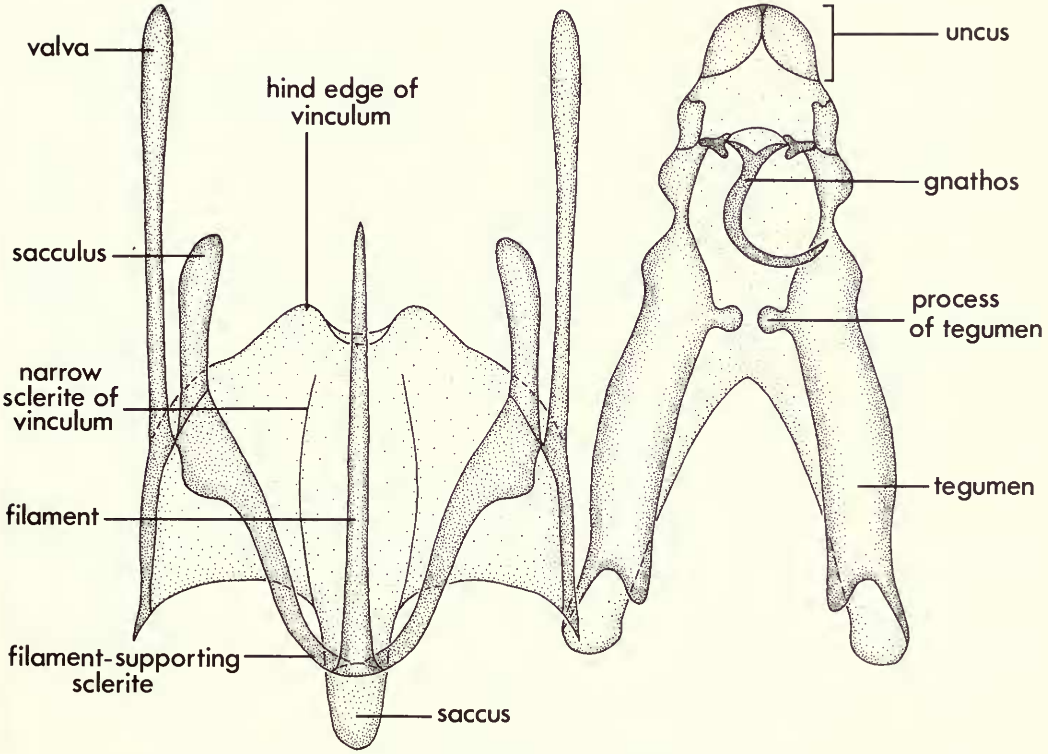
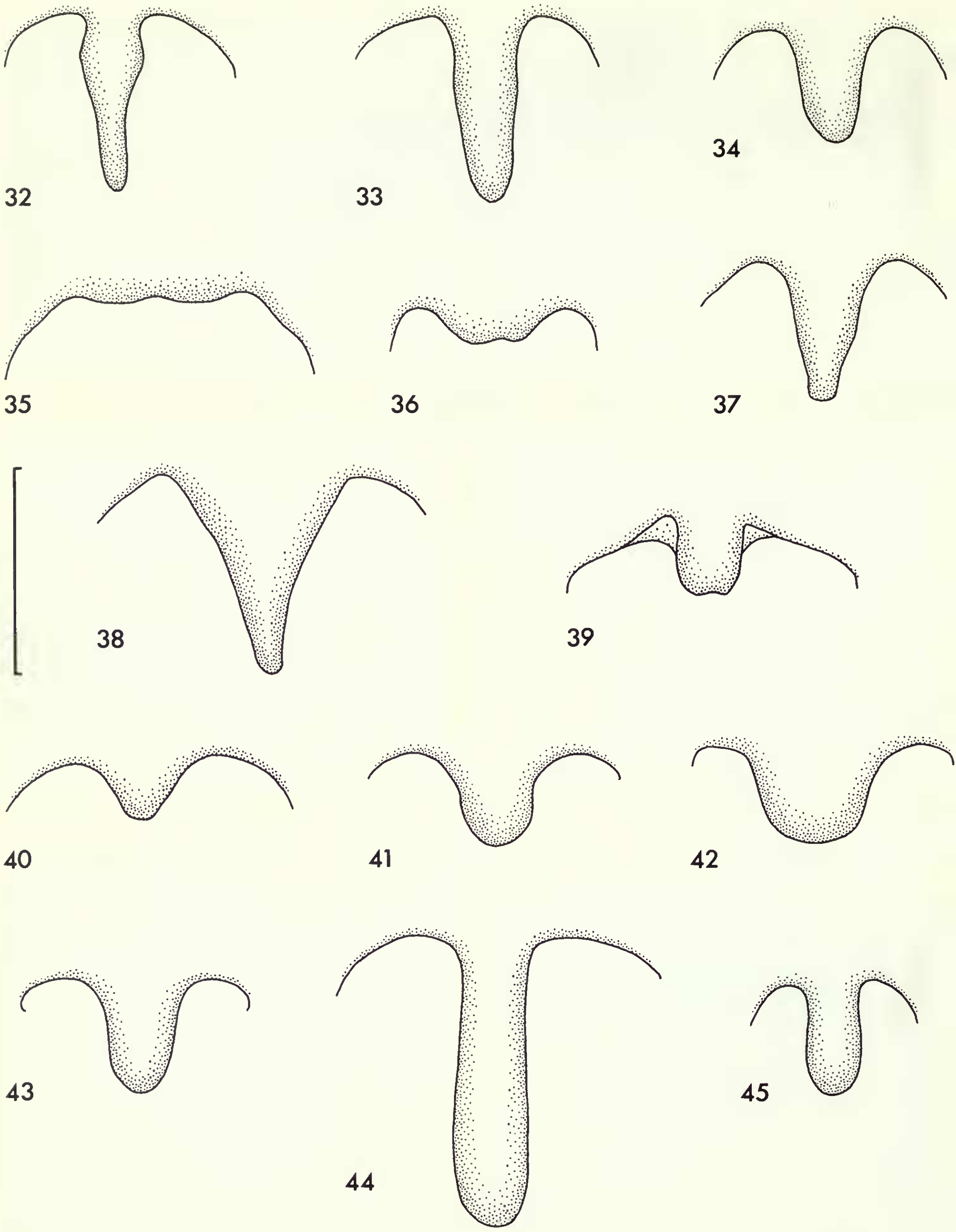
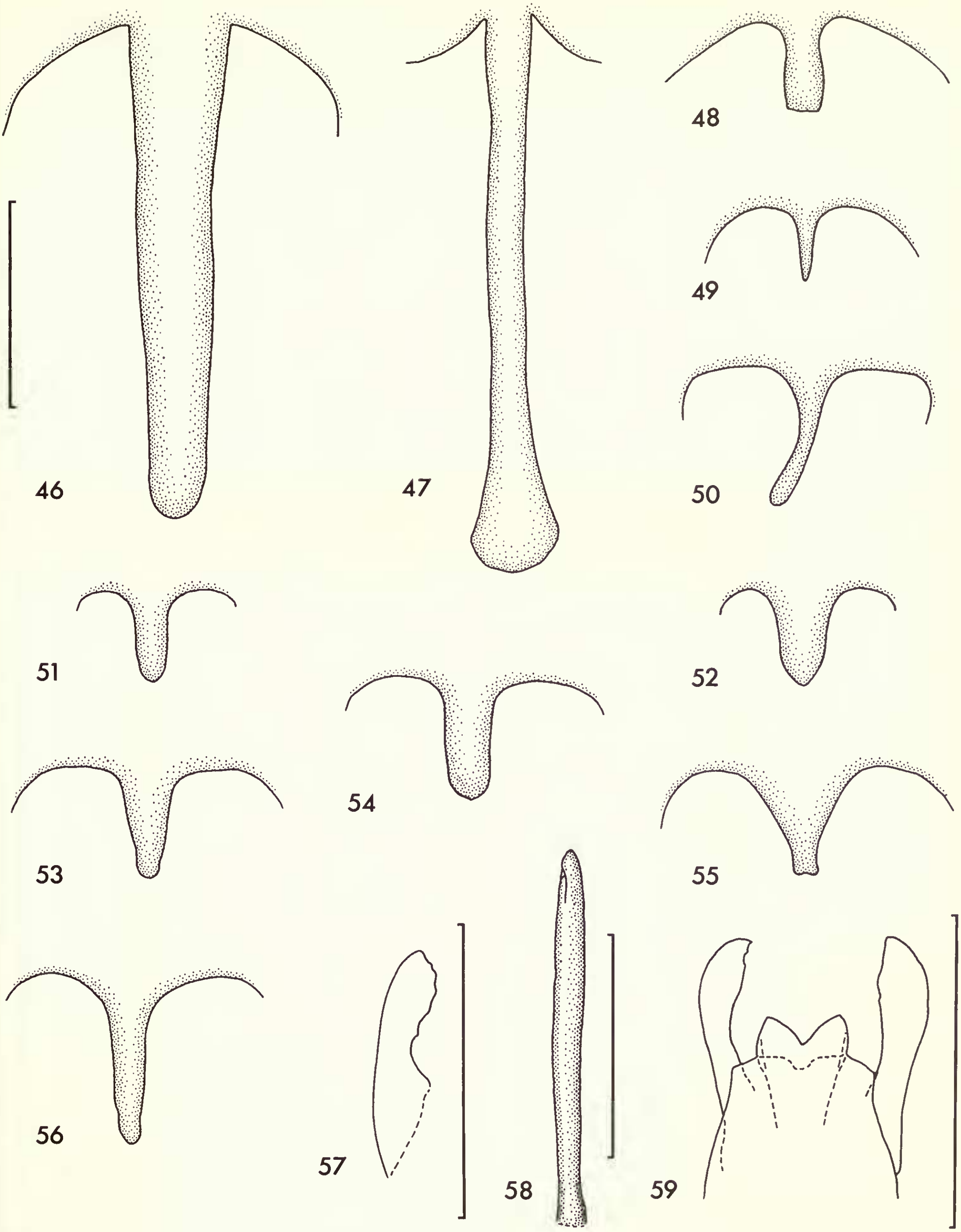


Fig. 31 Schematic diagram of the ♂ genitalia of *Mirificarma* combining some features of the different species-groups.



Figs 32–45 Saccus of *Mirificarma* species. 32, 33, variation in *M. montivaga* (Walsingham). 34, *M. scissella* (Chrétien). 35, *M. rhodoptera* (Mann), typical form. 36, *M. rhodoptera* (Mann), small form. 37, *M. denotata* sp. n. 38, *M. maculatella* (Hübner). 39, *M. pallidipulchra* (Walsingham). 40. *M. aflavella* (Amsel). 41, 42, variation in *M. flavella* (Duponchel). 43, *M. eburnella* ([Denis & Schiffermüller]). 44, *M. lentiginosella* (Zeller). 45, *M. constricta* sp. n. Scale = 0·25 mm.



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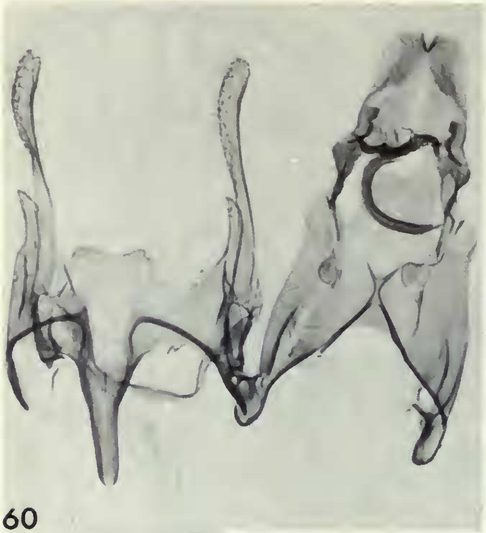
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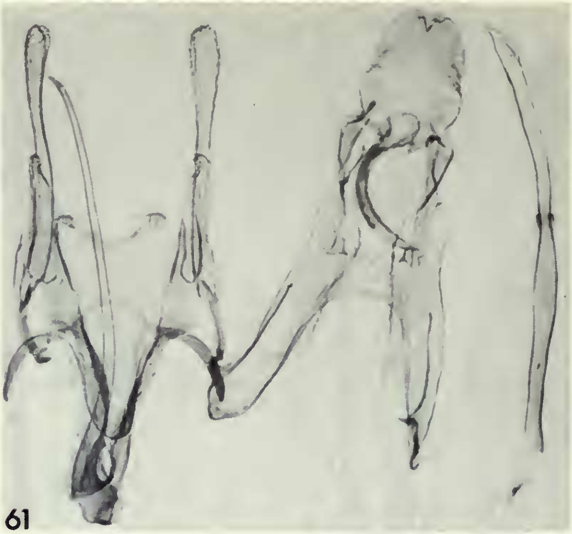
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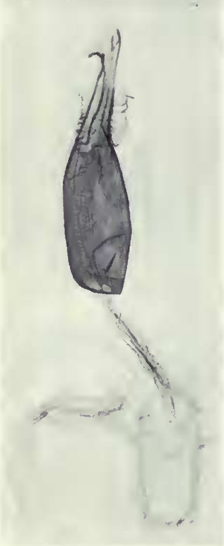

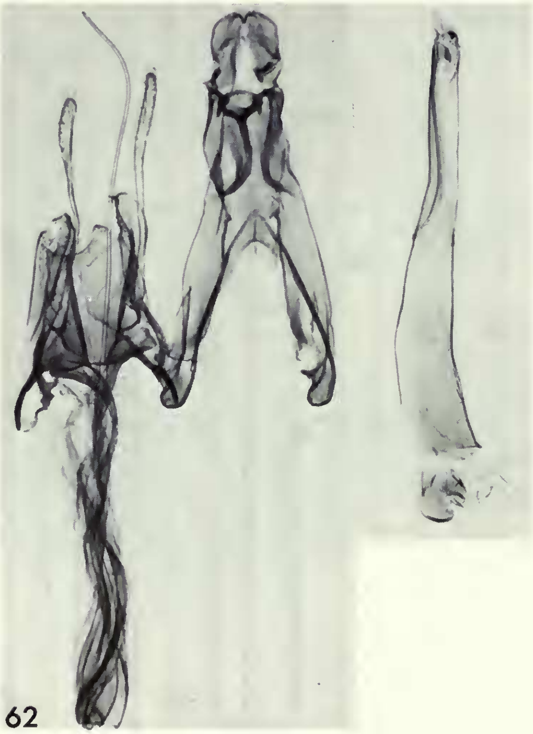
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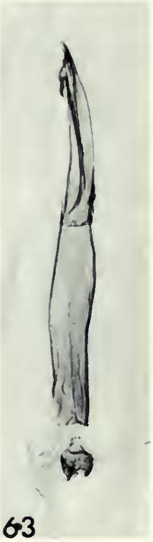
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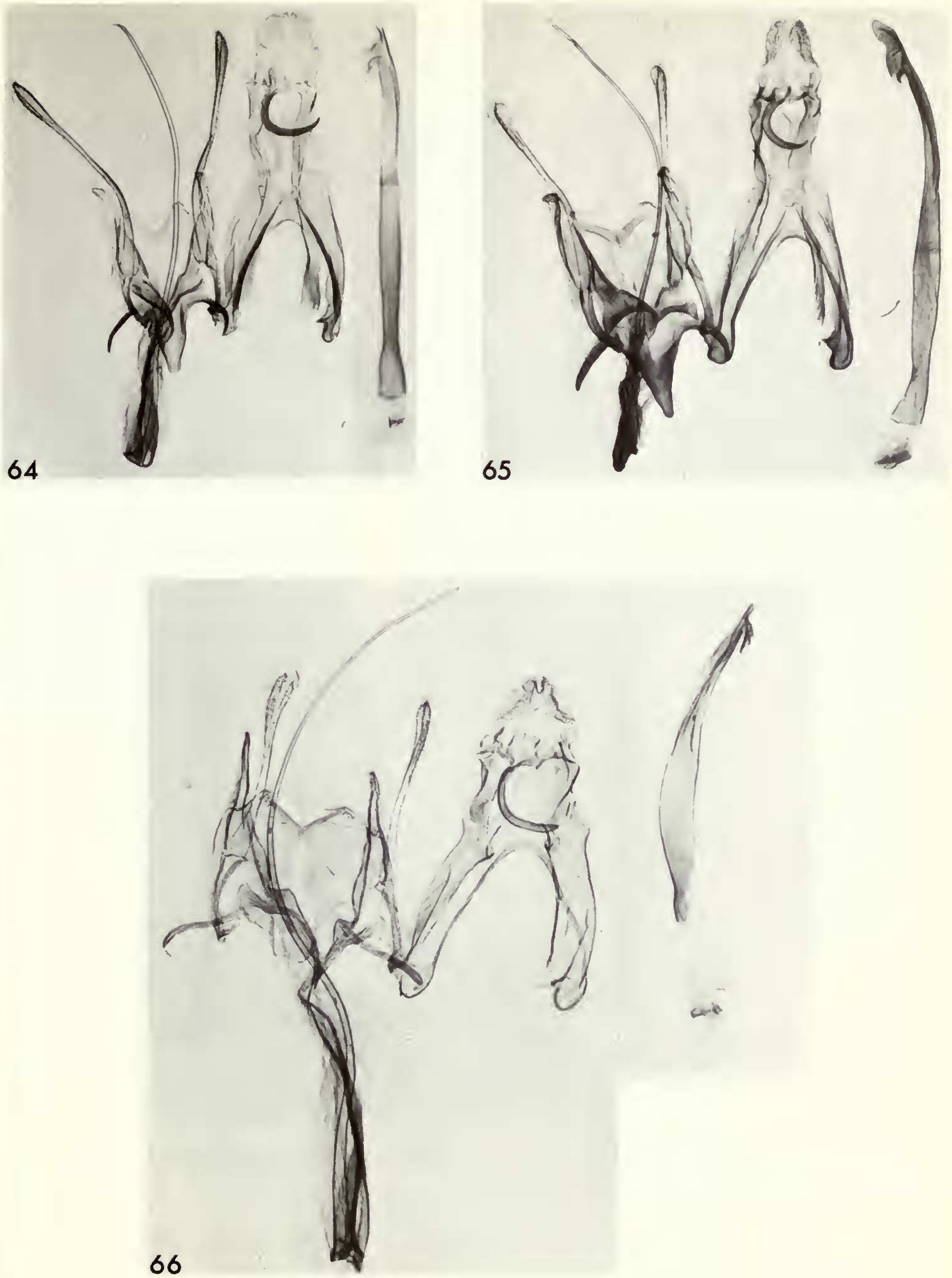

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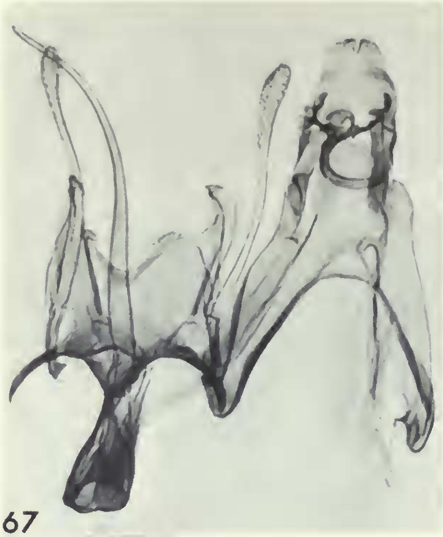

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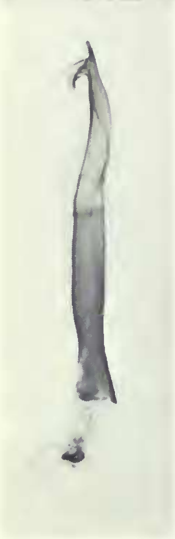

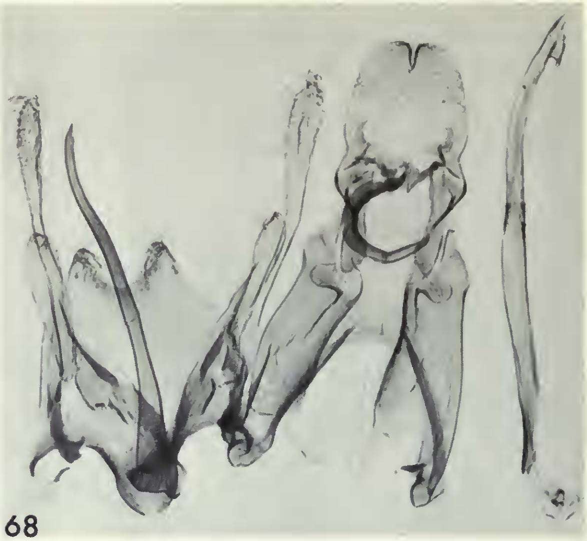

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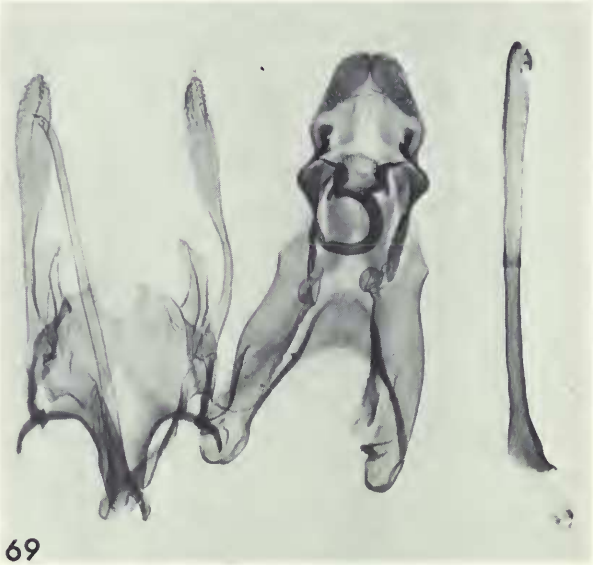

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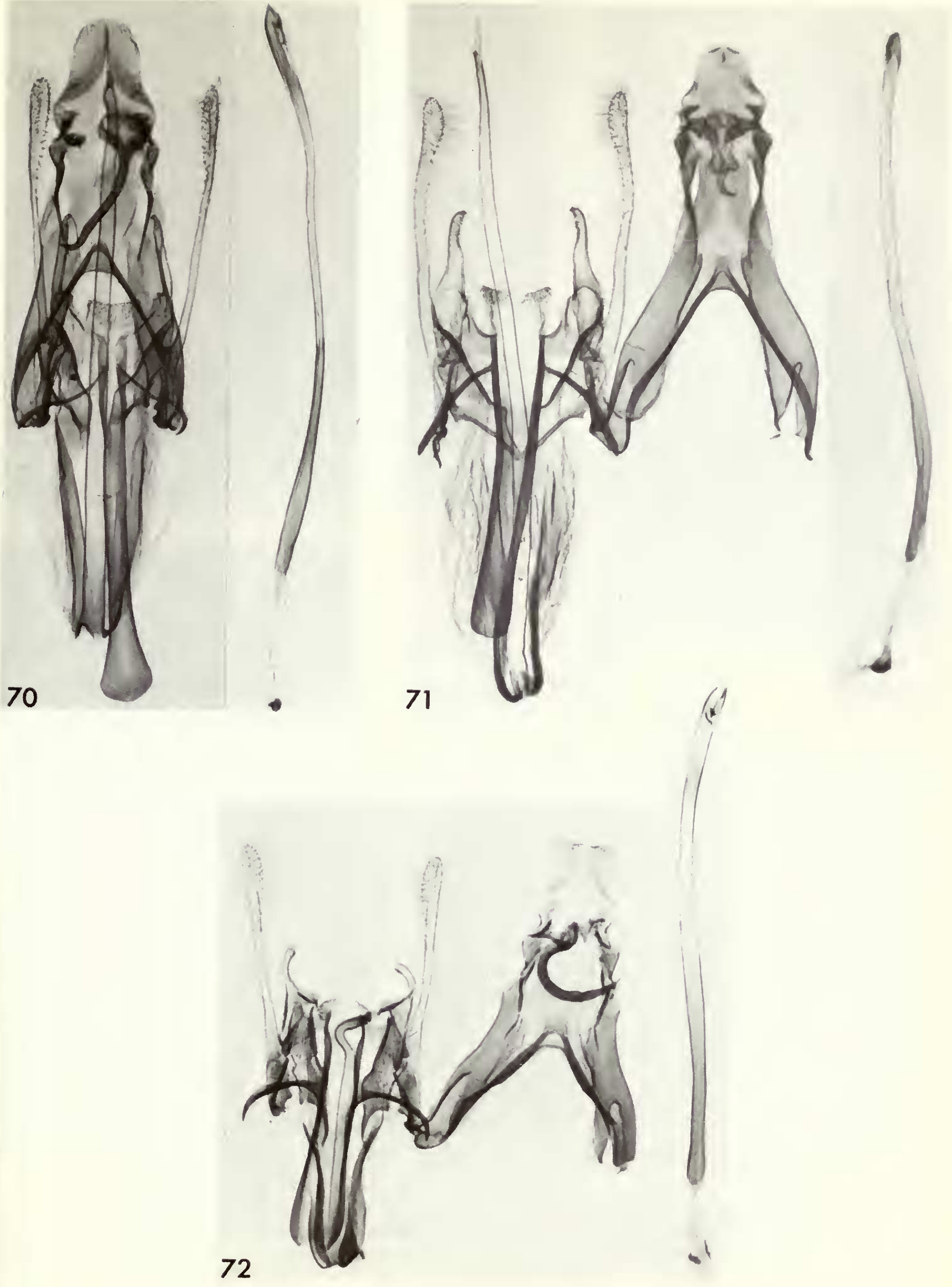

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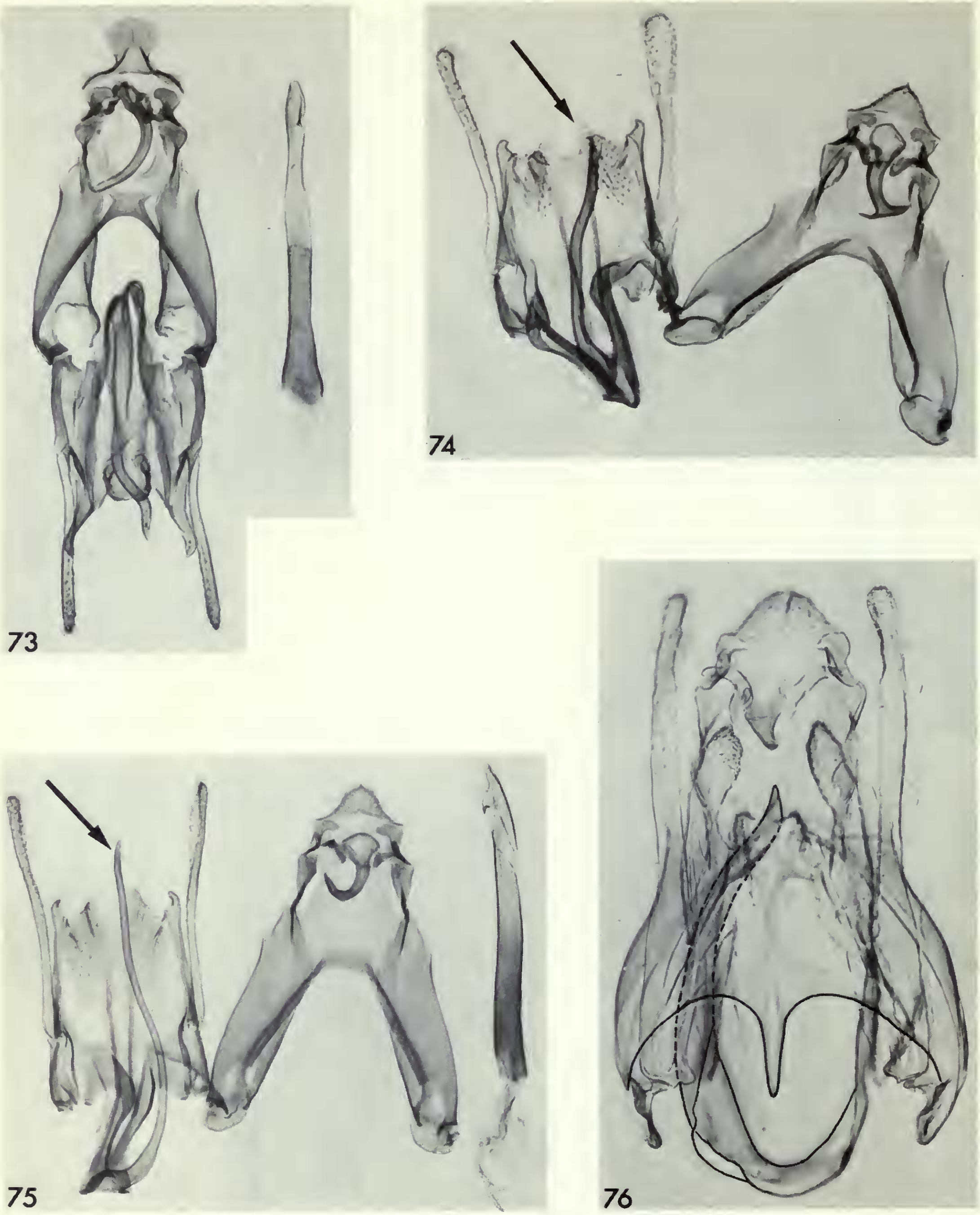

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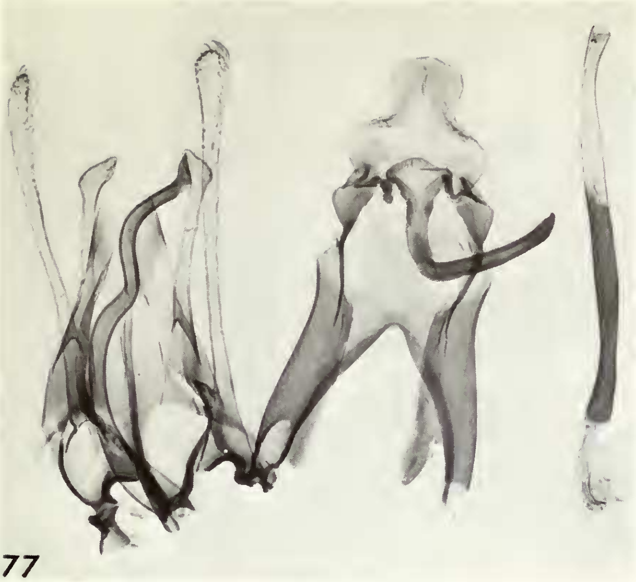
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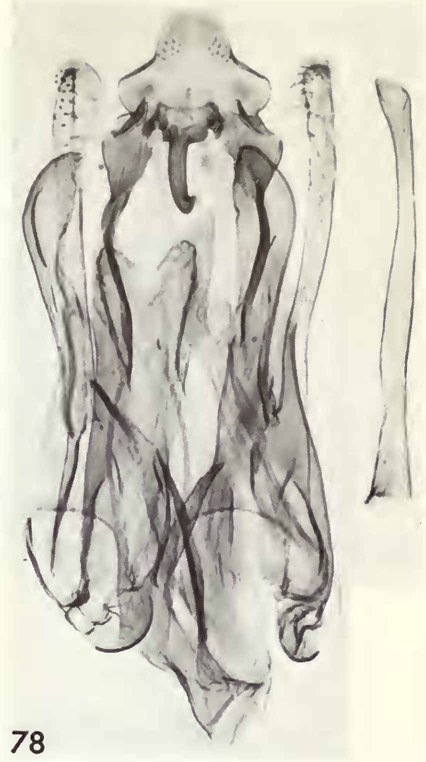
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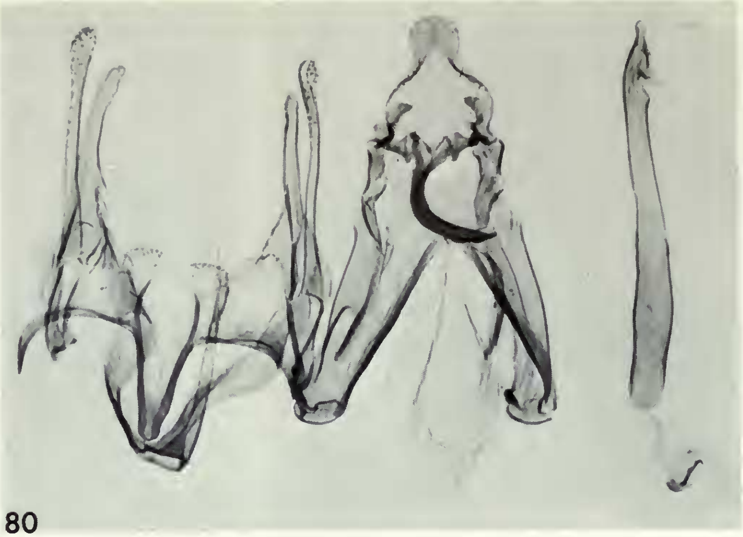

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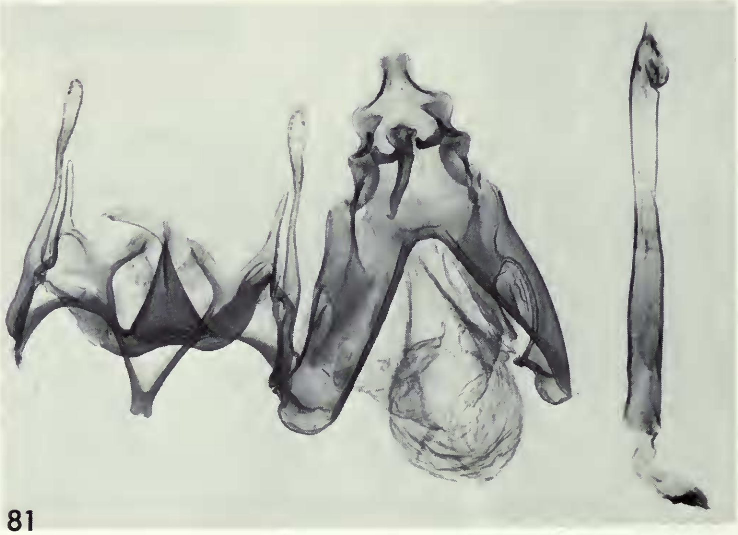

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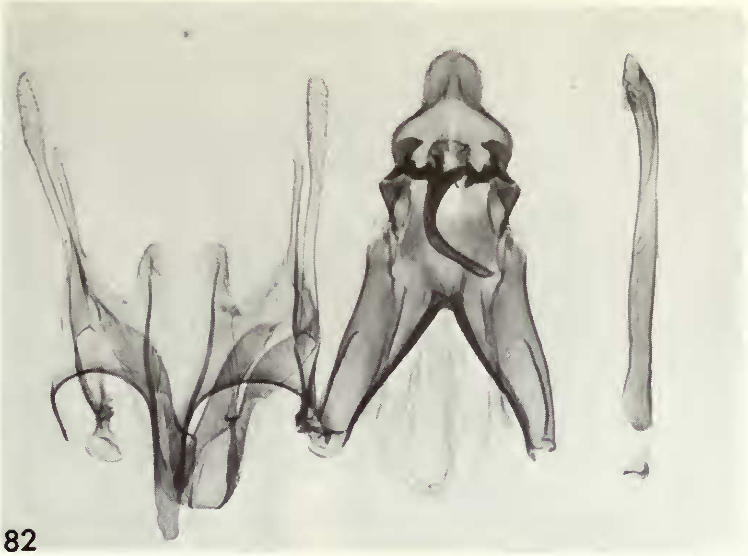

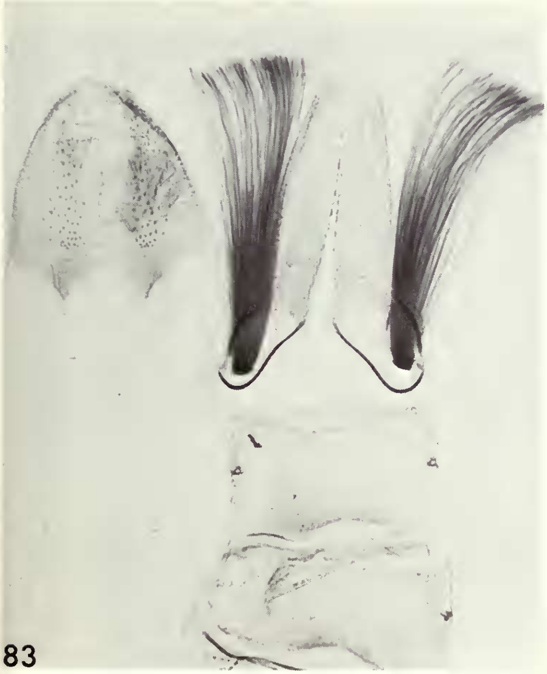

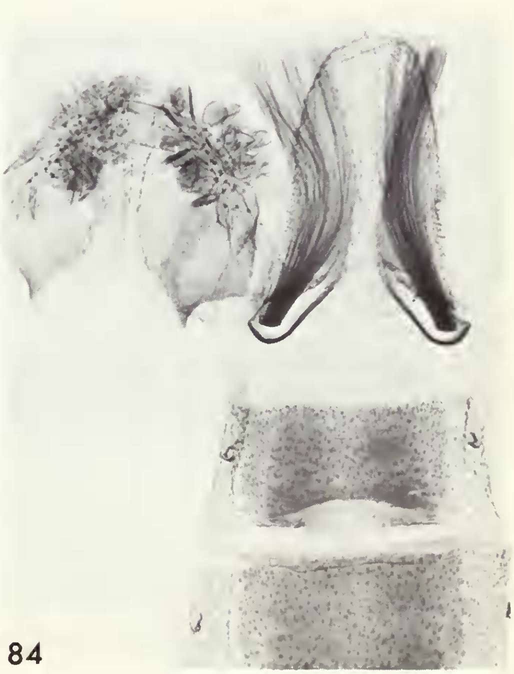

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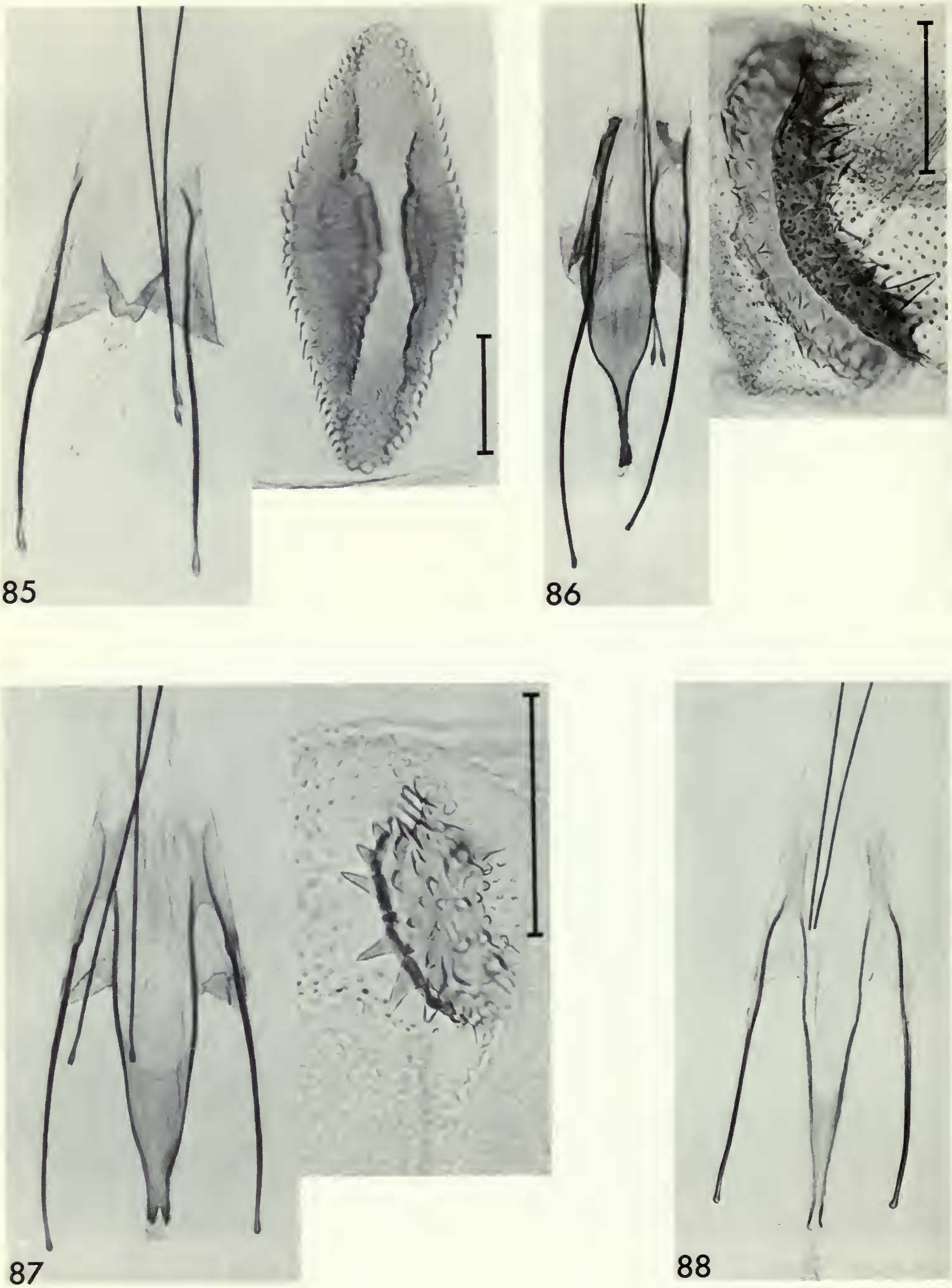

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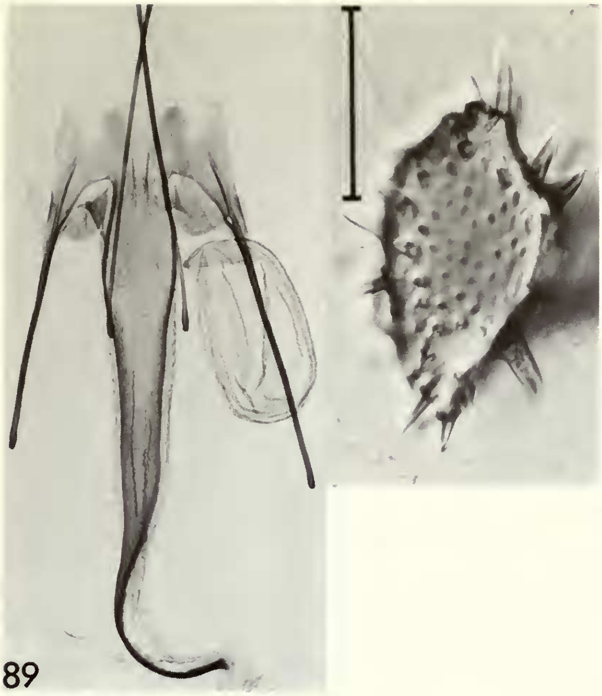

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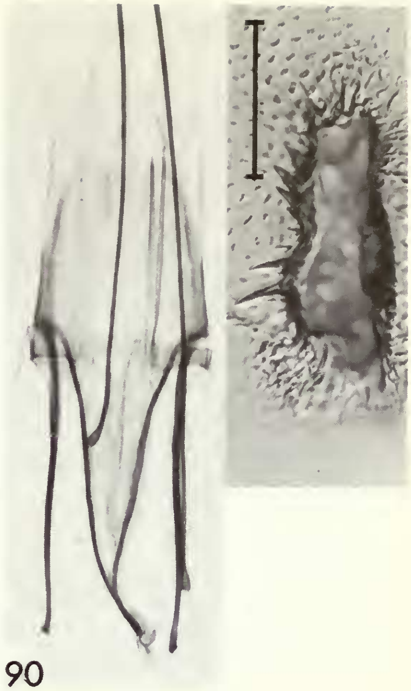

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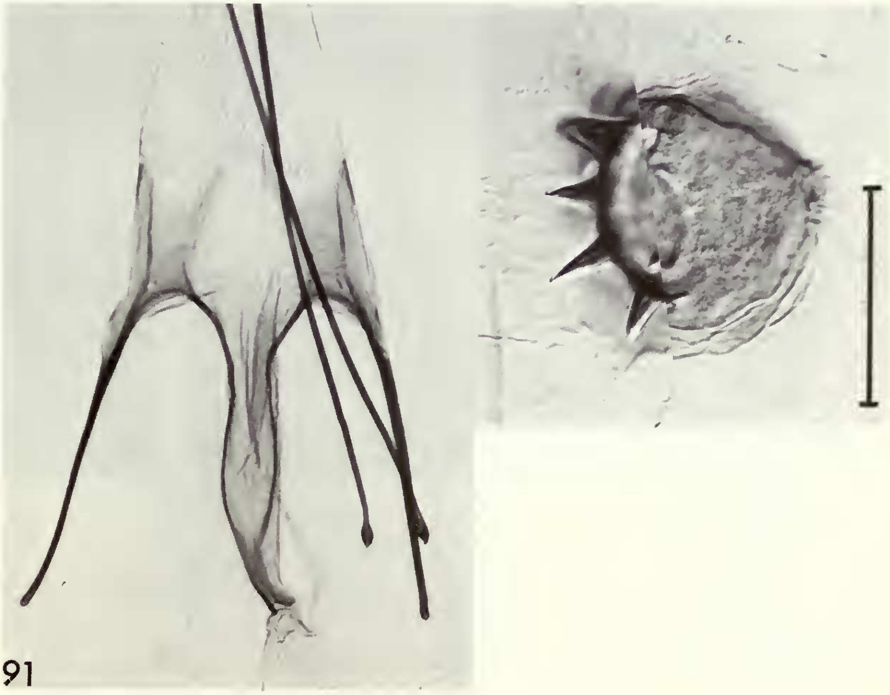

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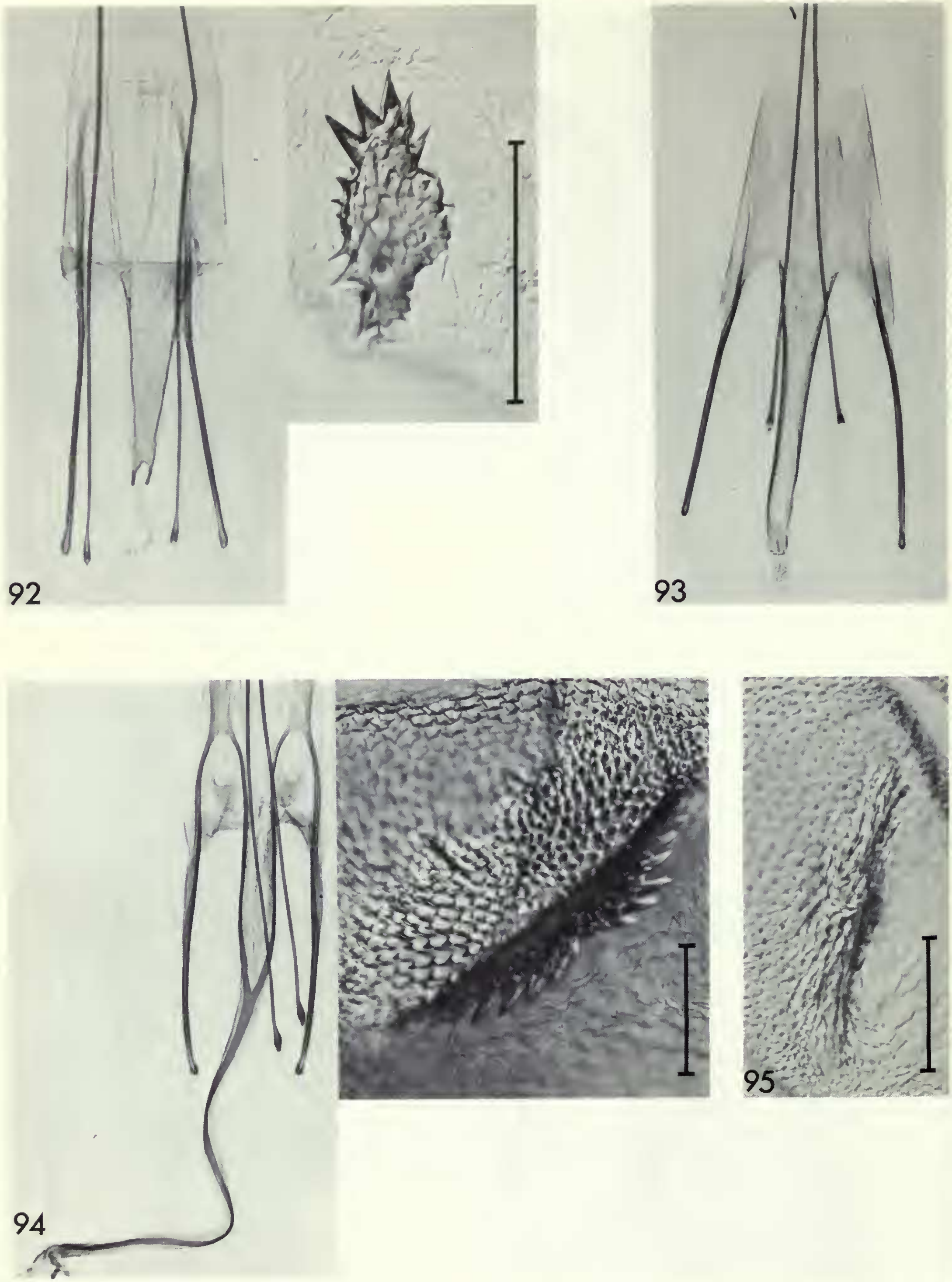

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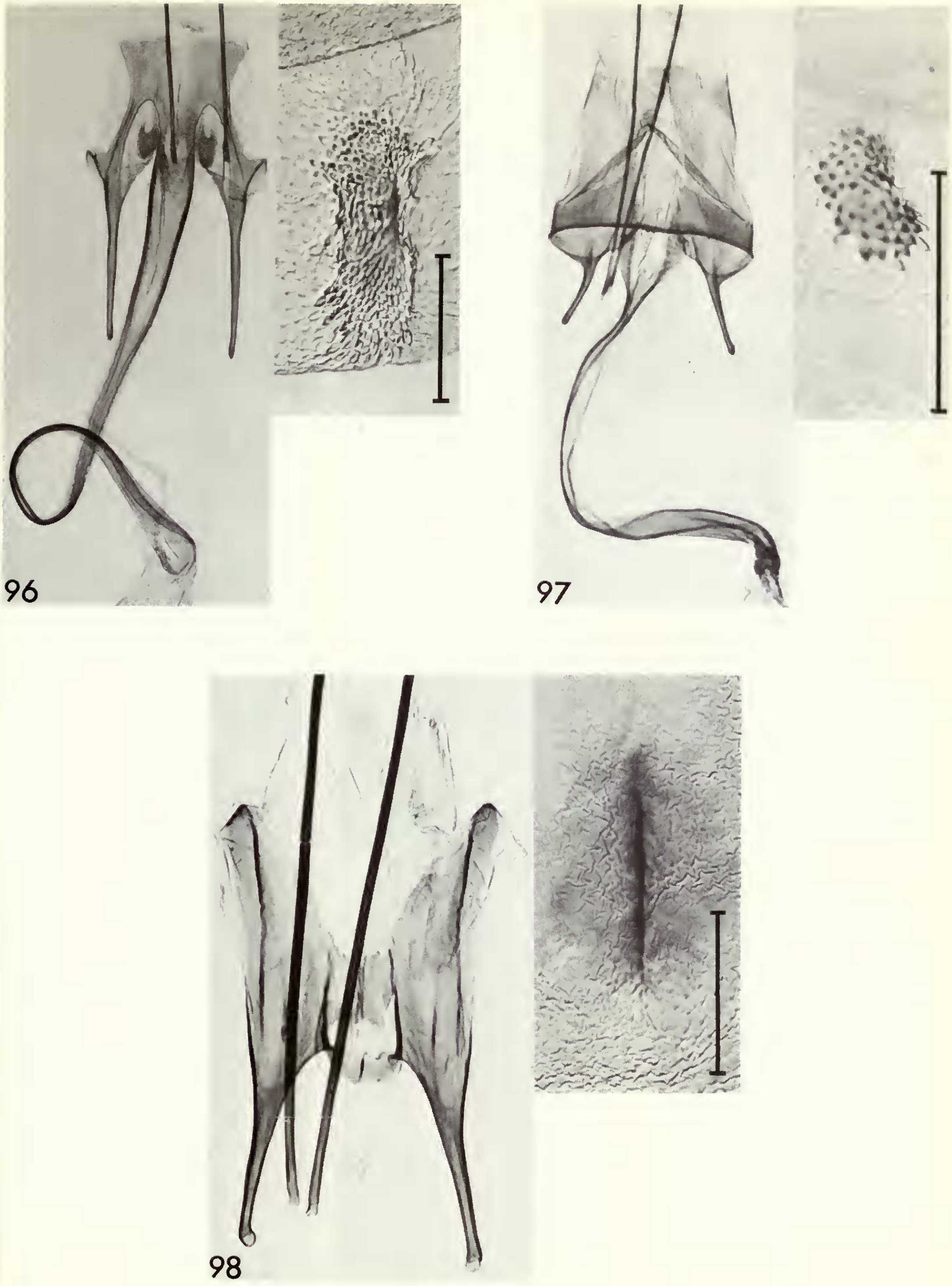

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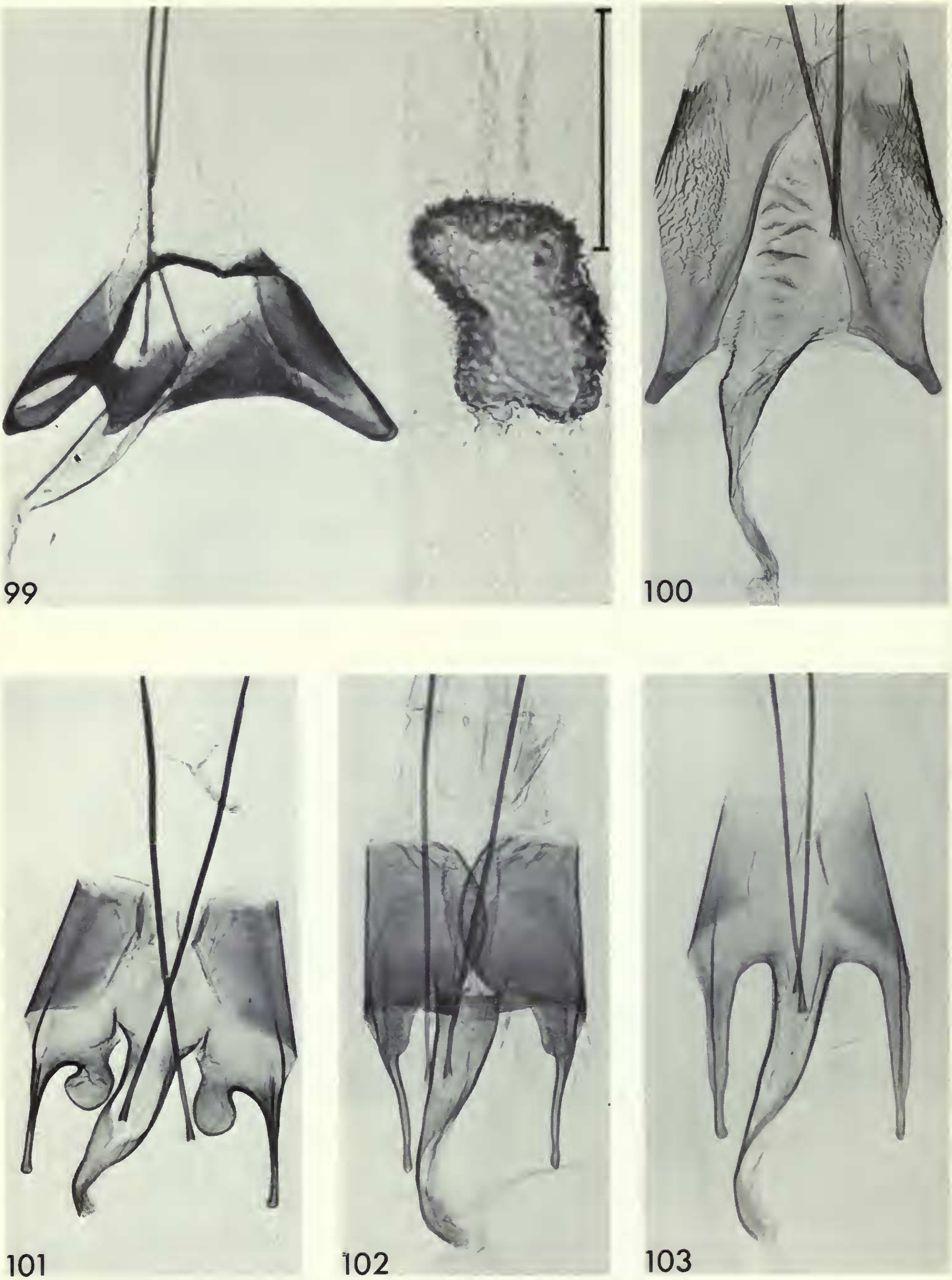

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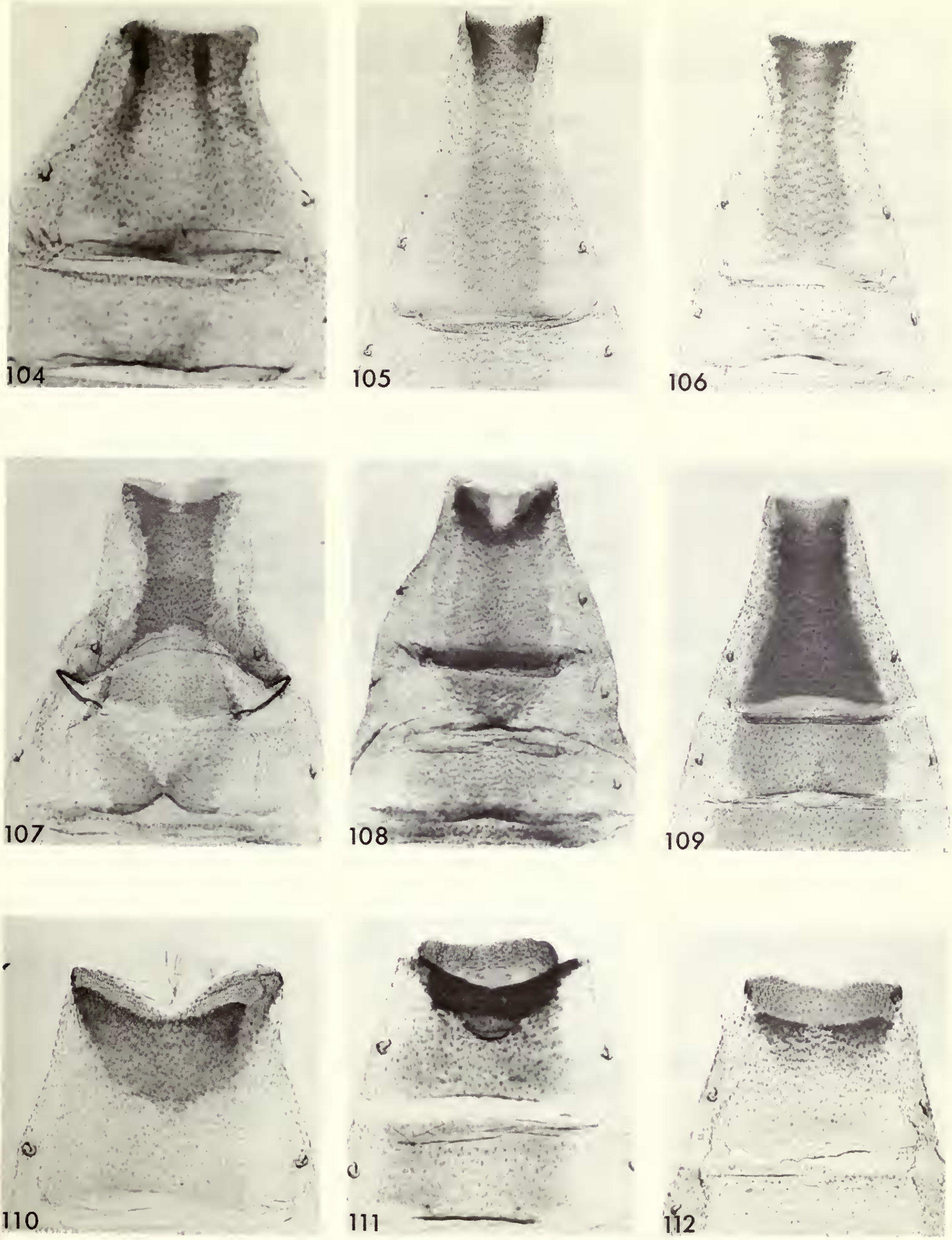

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